

Chapter 4: Nutrient Source Control Programs

Edited by William Baker¹, Jonathan Madden and Pamela Wade

SUMMARY

Source control program requirements are established by legislation for the Southern and Northern Everglades areas depicted in **Figure 4-1**. The Everglades Forever Act (EFA) [Section 373.4592, Florida Statutes (F.S.)] established source control requirements for the Everglades Construction Project (ECP) basins and the non-Everglades Construction Project (non-ECP) basins in the Southern Everglades with primary responsibility assigned to the South Florida Water Management District (District or SFWMD). The Northern Everglades and Estuaries Protection Program (NEEPP) (Section 373.4595, F.S.) established source control requirements for the Lake Okeechobee, Caloosahatchee River and Estuary, and St. Lucie River and Estuary watersheds (the Northern Everglades), with varying responsibilities accorded to each of the coordinating agencies — the District, Florida Department of Agriculture and Consumer Services (FDACS), and Florida Department of Environmental Protection (FDEP). The agencies implement their respective programs through specific rules promulgated by each agency based on statutory authorizations.

This chapter and related appendices (Appendices 4-1 through 4-3 of this volume) provide the Water Year 2013 (WY2013) (May 1, 2012–April 30, 2013) update on the nonpoint source control programs mandated by the EFA and NEEPP. The programs provide a consistent and comprehensive approach to nonpoint source control while recognizing the unique issues of each watershed and basin. These programs address the reduction of pollutants through on-site activities that prevent or reduce pollution at its source, such as agricultural and urban Best Management Practices (BMPs) and regulations. Nonpoint source control programs along with regional construction projects and point source programs are needed to achieve mandated water quality standards, including Total Maximum Daily Loads (TMDL) and Water Quality Based Effluent Limits (WQBEL). Construction projects and point source programs are described in the Northern Everglades protection plans (see Chapter 8 of this volume) and permit-specific reports are provided in Volume III. This chapter is specific to nonpoint source controls referred to hereafter as source control. A successful source control program includes comprehensive and cost-effective BMP plans, deadlines for implementation, verification of implementation, water quality monitoring, performance evaluation, and research and demonstration projects. Comprehensive BMP plans include on-site nutrient management practices and minimize off-site nutrient transport through water management and sediment controls.

Source control is an integral component of Southern and Northern Everglades restoration and protection programs. For the Southern Everglades, source control program planning is incorporated into the Long-Term Plan for Achieving Water Quality Goals in the Everglades Protection Area (Long-Term Plan) (Burns and McDonnell, 2003). For the Northern Everglades, source control program planning is incorporated into the Lake Okeechobee Watershed Protection Plan (LOWPP; Chapter 8 of this volume), and the Caloosahatchee and St. Lucie River watershed protection plans (Balci and Bertolotti, 2012a; Bertolotti and Balci, 2012b).

¹ Contributed as SFWMD staff during the draft SFER production cycle.

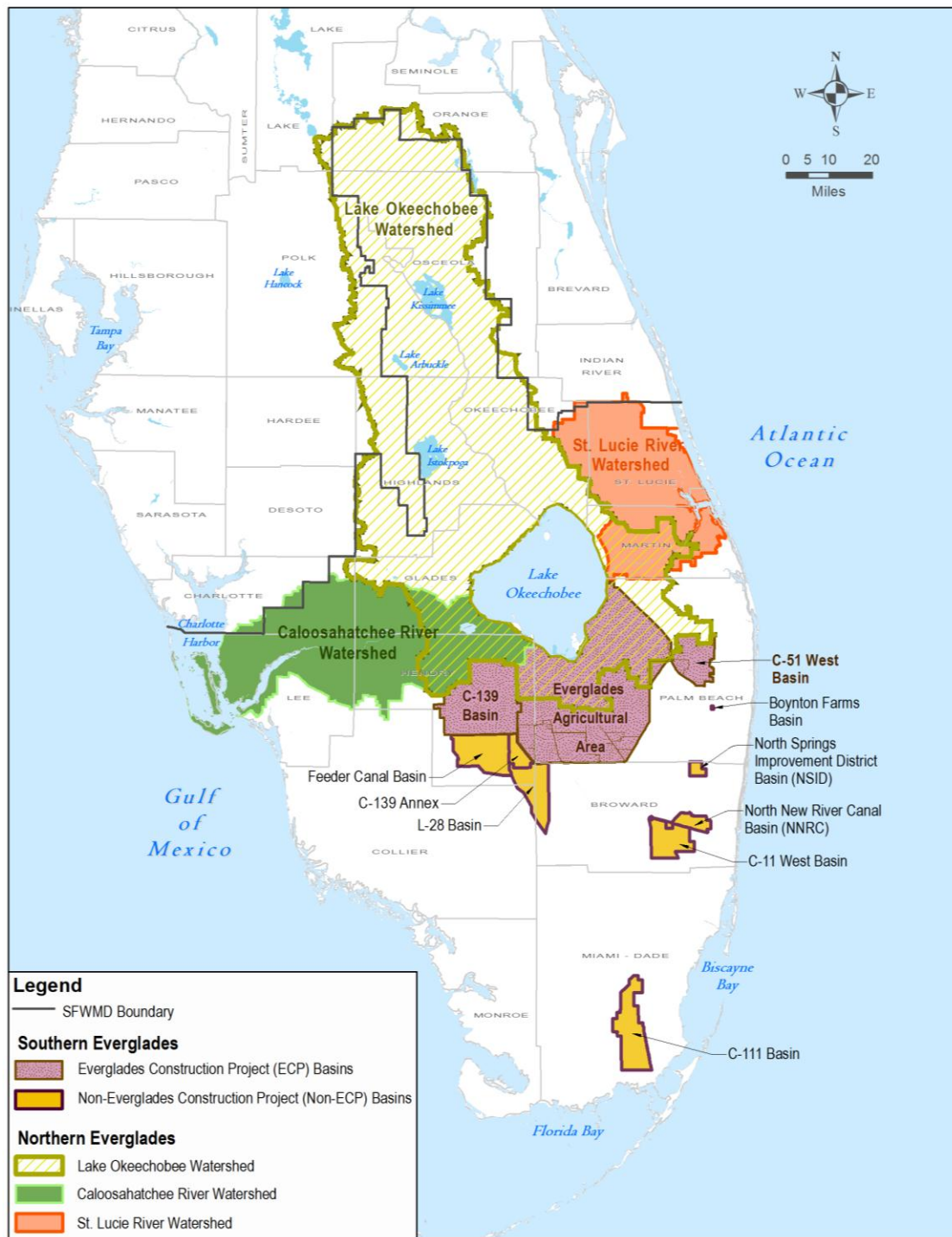


Figure 4-1. The Southern Everglades and Northern Everglades source control program implementation areas. [Note: Watershed areas overlap and are based on most recent hydrologic boundaries and may differ from areas shown in previous reports. SFWMD – South Florida Water Management District.]

WATER YEAR 2013 NUTRIENT SOURCE CONTROL HIGHLIGHTS

An overview of nutrient source control program status and related activities during WY2013 is presented below. A summary of the WY2013 total phosphorus (TP) discharge by basin is provided in **Table 4-1**.

Everglades Agricultural Area Basin

- The Everglades Agricultural Area (EAA) surpassed the required 25 percent reduction performance by achieving a 41 percent TP load reduction for WY2013 as compared with the rainfall adjusted pre-BMP baseline predicted load. This equates to a 108 metric ton (mt) reduction due to BMP implementation for WY2013. The total cumulative reduction in TP loads since WY1996 is 2,673 mt, which represents a long-term reduction of 55 percent.
- Post-permit compliance activities by the District are ongoing. BMP inspections were emphasized using a prioritized list based farm location, water quality history, size, and date of previous inspection.
- A five-year research project on improving BMP effectiveness through the control of floating aquatic vegetation continued for the third year through a cooperative effort between the District and the EAA Everglades Protection District.

C-139 Basin

- WY2013 was the second year of full implementation of comprehensive BMP plans as outlined in the amended Chapter 40E-63, Florida Administrative Code (F.A.C.).
- The C-139 Basin discharged 10 mt of TP, which is below the rainfall adjusted pre-BMP baseline predicted load of 22 mt and thus outperformed the requirement to maintain historical pre-BMP levels.
- Post-permit compliance activities were continued by the District. All permitted lands were inspected to verify BMP implementation in WY2013.
- Monitoring and data analyses efforts to identify upstream TP sources and potential water quality improvement projects to control those sources were assessed by the District.
- The District completed research and demonstration projects to improve BMP efficiencies within the basin.

Non-ECP Basins

- The total TP load of 15 mt discharged to the Everglades Protection Area (EPA) from the non-ECP basins during WY2013 represents continued decreased TP loads since the implementation of basin diversions and water quality improvement efforts.
- District projects and county cost-shared public outreach and education in the non-ECP basins supported water quality improvements in discharges to the EPA.

Lake Okeechobee Watershed

- The District and the coordinating agencies are currently working on an appropriate approach to measure and report on progress towards meeting water quality goals in the Lake Okeechobee watershed that streamlines efforts and avoids duplication across the three agencies.

- The District prepared supporting information and developed preliminary amendments to Chapter 40E-61, F.A.C., which include permit requirements, timelines for implementation, and expanded watershed boundaries.
- The District initiated a plan to implement additional BMPs on leased lands. These BMPs are supplemental to the lessee's existing BMP plan.
- The District and FDACS continue to develop and implement improved methods to share data for accurate representation of participation and implementation rates for FDACS agricultural BMP programs.

Caloosahatchee and St. Lucie River Watersheds

- The District and the coordinating agencies are currently working on an appropriate approach to measure and report on progress towards meeting water quality goals in the Caloosahatchee and St. Lucie River watersheds that streamlines efforts and avoids duplication across the three agencies.
- In support of rulemaking and Basin Management Action Plan development, historical data were evaluated and preliminary baselines were established for tracking progress toward achieving water quality goals for the St. Lucie River Watershed, followed by sensitivity analyses on the use of alternate base periods and rainfall stations. Analysis of total phosphorus and total nitrogen data for the Caloosahatchee River Watershed is under way and focused on developing data inventories for the tidal and coastal sub-watersheds.
- Water quality monitoring networks to evaluate progress toward achieving water quality goals were defined, and hydrologic evaluations to improve the delineation of tributary areas were completed.

Table 4-1. Summary of Water Year 2013 (WY2013) (May 1, 2012–April 30, 2013) total phosphorus (TP) discharge¹ by basin to all sources.
[Note: ppb – parts per billion; µg/l – micrograms per liter.]

| Basin | Watershed ² | Area ³ (acres ⁴) | TP Load (metric tons ⁵) | TP Unit Area Load (pounds per acre ⁵) | TP Concentration [ppb (µg/l)] |
|---|------------------------|--|--|--|-------------------------------------|
| Everglades Agricultural Area ⁶ | ECP | 468,059 | 154 | 0.73 | 141 |
| C-139 ⁶ | ECP | 168,450 | 10 | 0.13 | 116 |
| C-111 | Non-ECP | 72,902 | 3 | 0.09 | 8 |
| L-28 | Non-ECP | 71,790 | 4 | 0.12 | 50 |
| Feeder Canal | Non-ECP | 68,883 | 3 | 0.10 | 97 |
| C-11 West ⁷ | Non-ECP | 45,728 | 4 | 0.19 | 14 |
| North New River Canal | Non-ECP | 17,904 | no flow ⁸ | no flow ⁸ | no flow ⁸ |
| North Springs Improvement District | Non-ECP | 7,022 | 0.1 | 0.03 | 26 |
| Boynton Farms | Non-ECP | 217 | NA ^{8 & 11} | NA ^{8 & 11} | NA ^{8 & 11} |
| Upper Kissimmee | LOW | 1,028,421 | 49 | 0.10 | 90 |
| Lower Kissimmee | LOW | 429,188 | 101 | 0.52 | 175 |
| Lake Istokpoga | LOW | 394,203 | 32 | 0.18 | 92 |
| South Lake Okeechobee ⁹ | LOW/ECP | 321,168 | 24 | NA ¹⁰ | 288 |
| Fisheating Creek/Nicodemus Slough | LOW | 318,042 | 48 | 0.33 | 189 |
| Indian Prairie | LOW | 276,577 | 102 | 0.81 | 318 |
| Taylor Creek/Nubbin Slough | LOW | 196,732 | 137 | 1.54 | 534 |
| L-8 | LOW | 106,440 | 19 | 0.39 | 97 |
| S-4 | LOW/CRW | 42,145 | 14 | 0.73 | 174 |
| West Caloosahatchee | CRW | 350,115 | 87 | 0.55 | 139 |
| Tidal Caloosahatchee | CRW | 264,705 | NA ¹¹ | NA ¹¹ | 82 |
| Coastal Caloosahatchee | CRW | 229,322 | NA ¹¹ | NA ¹¹ | 44 |
| East Caloosahatchee | CRW/LOW | 204,094 | 42 | 0.45 | 209 |
| C-44 | SLRW/LOW | 132,572 | 59 | 0.98 | 306 |
| North Fork | SLRW | 131,864 | NA ¹¹ | NA ¹¹ | 79 |
| C-23 | SLRW | 110,874 | 52 | 1.03 | 492 |
| C-24 | SLRW | 83,373 | 56 | 1.48 | 297 |
| South Fork | SLRW | 48,777 | NA ¹¹ | NA ¹¹ | 91 |
| Basins 4, 5 & 6 | SLRW | 15,934 | NA ¹¹ | NA ¹¹ | 175 |
| South Coastal | SLRW | 7,991 | NA ¹¹ | NA ¹¹ | 77 |
| North and South Mid Estuary | SLRW | 6,275 | NA ¹¹ | NA ¹¹ | 48 |

¹ Data presented in this table may have more than one receiving body and may differ from Chapter 8, where there is overlap, since Chapter 8 focuses solely on TP loads entering Lake Okeechobee. Cell shading indicates the relative magnitude of each value.

² LOW = Lake Okeechobee Watershed, CRW = Caloosahatchee River Watershed, SLRW = St. Lucie River Watershed, ECP = Everglades Construction Project basins, Non-ECP = Non-Everglades Construction Project basins

³ Sub-watershed acreage is based on most recent hydrologic boundaries and may differ in total acreage from previous reports.

⁴ 1 acre = 0.4047 hectares.

⁵ 1 metric ton = 1,000 kg and 1 pound per acre = 1.12 kilogram per hectare.

⁶ The Everglades Construction Project (ECP) basins discharge receive further treatment downstream through the STAs prior to discharge to the EPA.

⁷ The C-11 West Basin flows west to Water Conservation Area 3A through pumps S-9 and S-9A to the EPA, and also flows east through S-13A. The reported unit area load represents only the portion of TP load directed to the EPA.

⁸ No discharges to the EPA during WY2013.

⁹ The South Lake Okeechobee Sub-watershed load includes TP load into Lake Okeechobee only. The sub-watershed can also discharge south to the stormwater treatment areas (STAs) Everglades Protection Area (EPA) which are included in the Everglades Agricultural Area load.

¹⁰ NA – not available. The unit area load for the South Lake Okeechobee Sub-watershed is not presented in this table because the sub-watershed can also discharge south to the stormwater treatment areas (STAs) Everglades Protection Area (EPA), and therefore, the TP load presented does not represent the total TP load from the area.

¹¹ NA – not available. No instrumentation is in place for flow and/or water quality monitoring.

OVERVIEW OF SOUTHERN EVERGLADES SOURCE CONTROL PROGRAMS

William Baker¹

The Southern Everglades source control program is one of several strategies to achieve water quality standards in the Everglades Protection Area (EPA). The program includes implementation of phosphorus reduction best management practices (BMPs) and regulatory, voluntary, and educational programs as well as integration of state, local, and regional water quality projects. The Everglades Forever Act (EFA), Section 373.4592, Florida Statutes (F.S.), outlines the South Florida Water Management District's (District or SFWMD) responsibilities and schedules to implement basin-specific solutions to control phosphorus at the source.

The EFA mandates specific performance levels for controlling phosphorus in discharges from the Everglades Agricultural Area (EAA) and C-139 basins that discharge to the Everglades Construction Project (ECP) basins prior to discharge to the EPA. For other basins that discharge to the EPA [the non-Everglades Construction Project (non-ECP) basins], the EFA requires the Florida Department of Environmental Protection (FDEP) to issue long-term compliance permits to the District to regulate phosphorus levels in discharges. See **Figure 4-1** for general basin and EPA locations. BMP implementation guidelines are outlined in a District regulatory rule [Chapter 40E-63, Florida Administrative Code (F.A.C.), available at www.sfwmd.gov/rules] for the EAA and C-139 ECP basins, and through FDEP Permit Number 06, 502590709 for non-ECP basins. The District is required to implement, monitor, optimize, and annually report on each basin's progress in accordance with the EFA. This chapter and related Volume I and Volume III appendices serve as the reporting mechanisms to fulfill this requirement.

Background and details for source control program implementation in all basins with discharges to the EPA, including requirements for (1) implementing BMP plans, discharge monitoring plans, and water quality improvement plans (WQIPs), (2) research and demonstration projects, (3) data evaluation, (4) compliance methodologies and determinations, and (5) educational and outreach activities, have been extensively reported in previous *South Florida Environmental Reports* (SFERs). This chapter provides an update on the Water Year 2013 (WY2013) (May 1, 2012–April 30, 2013) status and highlighted activities.

Continued implementation of mandatory BMP programs in the EAA and C-139 basins and WQIPs in non-ECP basins, and achievement of the required levels of performance in total phosphorus (TP) loading from these basins are necessary for the District to achieve the phosphorus criterion in the EPA and fulfill its obligations under the EFA and the federal Everglades Settlement Agreement (Settlement Agreement dated July 26, 1991, Case No. 88-1886-CIV-MORENO, United States District Court for the Southern District of Florida, as modified by the Omnibus Order entered in the case on April 27, 2001). During WY2013, the District continued to implement the source control activities on a basin-specific basis. Detailed updates on these activities are provided in the *Status of Source Control in the ECP Basins* and *Status of Source Control in the Non-ECP Basins* sections of this chapter. Supplemental information for the ECP and non-ECP basins is provided in Appendices 4-2 and 4-3 of this volume, respectively.

The long-term Everglades water quality goal is for all discharges to the EPA to achieve and maintain water quality standards in the EPA, including compliance with the TP criterion established in Rule 62-302.540, F.A.C. This goal will be accomplished through a combination of TP control strategies as outlined in the Restoration Strategies Regional Water Quality Plan (SFWMD, 2012). Controlling phosphorus at the source is a critical component of water quality improvement strategies in the Everglades restoration program.

STATUS OF SOURCE CONTROL IN THE ECP BASINS

Carlos Adorisio, Ximena Pernet,
Steve Sarley and Doug Pescatore

Contributors: Carmela Bedregal, Jonathan Madden,
Cordella Miessau and William Baker¹

BACKGROUND

For the EAA and C-139 basins, the EFA mandates a nonpoint regulatory source control program to implement BMPs to control phosphorus at the source and a monitoring program to assess program effectiveness [Paragraph 373.4592(4)(f), F.S.]. The EFA further mandates that Chapter 40E-63, F.A.C., is to outline the specific methodology and permissible TP loading levels for both basins based on historical data or pre-BMP baseline periods defined in the EFA. Achieving TP load requirements from these tributary basins is critical to the success of the ECP because the stormwater treatment areas (STAs) were designed based on historical data and an expected range of inflow TP loads. The source control program's mandated implementation of BMPs in the EAA and C-139 basins are the primary regulator of TP loads in discharges from the basins prior to inflow to an STA. Along with the design characteristics of the STAs, performance of an STA in reducing TP concentrations to meet EPA water quality standards relies on the level of phosphorous discharged to the STA for treatment.

The EFA mandates an agricultural privilege tax for both the EAA and C-139 basins to be used towards the funding of the ECP. For the EAA, the legislature provided a tax incentive credit against the EAA agricultural privilege tax for any phosphorous load reductions achieved in excess of 25 percent to encourage BMP performance and maximize load reductions. The minimum tax rate for the EAA with incentive credits is \$24.89 per acre for notices mailed out from 1994 through November 2013. For notices mailed out from November 2014 to November 2026 the tax rate will not include incentive credits and will be \$25 per acre. For notices mailed out November 2027 to November 2029 the tax rate will be \$20. For notices mailed out November 2030 to November 2035 the tax rate will be \$15. For notices mailed out November 2036 and thereafter, the tax rate will reduce to \$10 per acre. For the C-139 Basin, the tax rate from 2003 to November 2013 is set at \$4.30 per acre, which will reduce to \$1.80 per acre for tax notices mailed out November 2014 and thereafter. Further details can be found in Appendix 4-2.

The EAA Basin is required to achieve a 25 percent reduction of the TP loads discharged when compared to the pre-BMP baseline period as defined in the EFA. The specific compliance methodology to assess if the 25 percent reduction goal is being met is also defined in Chapter 40E-63, F.A.C., and outlined in the *Water Year 2013 Phosphorus Results* section.

The District collects monitoring data from the EAA Basin at discharge locations to evaluate the overall effectiveness of the BMPs in achieving and maintaining compliance with the TP load reduction requirement. If the EAA Basin is determined to be out of compliance, then, in accordance with the rule, the data collected by the individual permittees under an approved discharge monitoring plan for each farm are evaluated using a secondary compliance method that assesses individual farm TP load contributions and individual farm compliance. However, the rule does not have a provision for use of TP load data from individual farms for determining compliance when the basin-level TP load reduction requirement is met.

For the C-139 Basin to be in compliance, it must also meet phosphorus levels relative to the EFA-defined baseline period using specific methods defined within Chapter 40E-63, F.A.C. Unlike the EAA, which has a load reduction requirement of 25 percent, the C-139 Basin mandate is to maintain the historical load levels observed during the baseline period.

The EFA states that if the C-139 Basin is out of compliance, actions required from individual landowners are conditioned on the proportional share of the TP load discharged from the basin. A secondary compliance determination (specified in Chapter 40E-63, F.A.C.) for individual landowners in the C-139 Basin is an optional farm-level compliance and monitoring program. However, since permittees in the C-139 Basin are not required to collect water quality and quantity data to characterize farm-level discharges, a water quality and quantity monitoring network for upstream areas throughout the basin is used by the District to differentiate the relative contribution of the hydrologic sub-basins within the C-139 Basin that will support water quality improvement activities if necessary. The specific procedures for determining EAA and C-139 Basin compliance, basin-level data collection efforts, and farm-level discharge monitoring results are outlined in Appendix 4-2.

Investigation to improve the selection, design criteria, and implementation of BMPs is ongoing and occurs through different mechanisms based on the factors specific to each basin. This section provides a WY2013 update on compliance with TP loading limits and source control strategies for the EAA and C-139 basins and includes WY2013 phosphorus results, monitoring program updates, investigative activities, program accomplishments, ongoing activities, and planned initiatives.

EVERGLADES AGRICULTURAL AREA BASIN UPDATE

During WY2013, the TP loads discharged from the EAA Basin decreased by 41 percent compared to the predicted load from the pre-BMP baseline period adjusted for hydrologic variability associated with rainfall. This represents the eighteenth consecutive year the EAA Basin was in compliance. Because the EAA Basin has been in compliance each year since the program's inception, the secondary compliance method at the permit-level has not been necessary. Representative monitoring locations for determining WY2013 compliance with the TP load reduction requirement are shown in **Figure 4-2**.

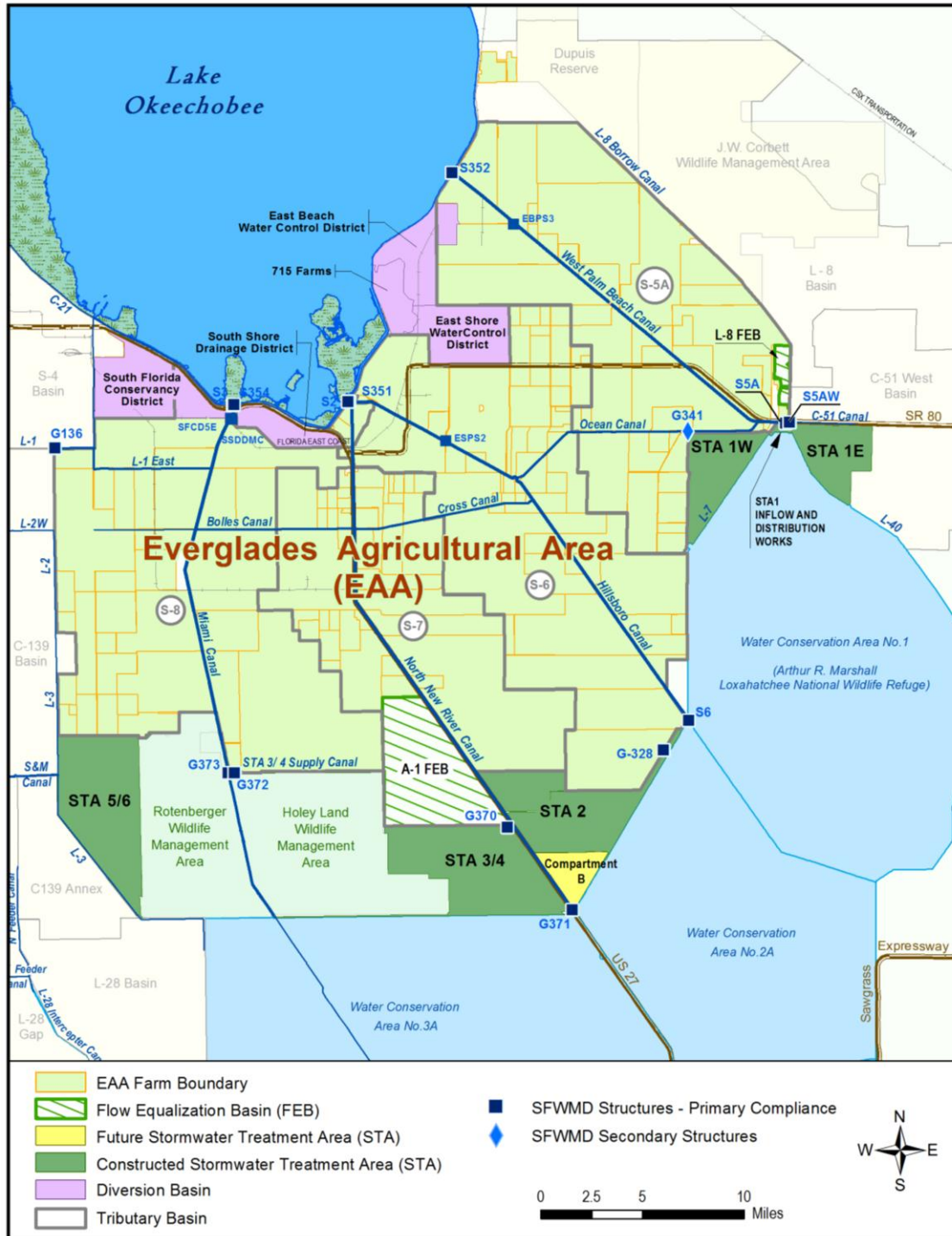


Figure 4-2. Water Year 2013 (WY2013) (May 1, 2012–April 30, 2013)
Everglades Agricultural Area (EAA) Basin boundaries and
primary compliance water control structures.

Water Year 2013 Phosphorus Results

This section provides an update on the observed WY2013 TP loads in comparison to the basin's EFA-mandated load requirements as defined by Chapter 40E-63, F.A.C. Additional detailed information on the EAA Basin-level monitoring program and summaries of sub-basin flows, related TP loads, and TP flow-weighted mean (FWM) concentrations are presented in Appendix 4-2 of this volume.

Table 4-2 provides a summary of the EAA WY2013 results for the observed and performance measure TP loads in metric tons (mt). The observed load is based on flow and water quality data measured during the water year. The target load is the predicted pre-BMP baseline period load reduced by 25 percent to reflect the EFA load reduction requirement. The target prediction uses a base period regression model with the current water year rainfall characteristics to account for the hydrologic variability between WY2013 and the baseline period. Target loads are evaluated based on exceedance for three consecutive years to verify noncompliance at a theoretical confidence level of 87.5 percent. The single-year limit load is calculated based on the 90th percentile confidence level of the target load. The limit load provides for a higher theoretical confidence level to verify noncompliance based on an exceedance in a single year. The predicted load is the modeled pre-BMP baseline period load prior to reductions considering current water year rainfall characteristics. Details of target and limit load calculations and performance evaluation can be found in Appendix 4-2 of this volume and Chapter 40E-63, F.A.C. **Table 4-2** also summarizes TP concentrations in parts per billion (ppb) [1 ppb = 1 microgram per liter (µg/L)].

Table 4-2. Results of WY2013 Everglades Agricultural Area (EAA)
Basin TP compliance calculations.

| TP Load | |
|--|-----------------------------|
| Predicted TP load (adjusted for WY2013 rainfall amounts and monthly distribution relative to baseline period) ¹ | 263 metric tons (mt) |
| Target TP load (predicted TP load reduced by 25 percent) | 197 mt |
| Limit TP load (upper 90 percent confidence limit for target load) | 265 mt |
| Observed WY2013 TP load from the EAA with best management practices (BMPs) implemented | 154 mt |
| WY2013 TP load reduction (relative difference between observed and predicted TP loads) | 41% |
| Five-year TP load reduction | 60% |
| TP Concentration | |
| Observed EAA flow-weighted mean (FWM) TP concentration prior to BMP implementation (WY1980–WY1988) ¹ | 173 parts per billion (ppb) |
| Observed WY2013 FWM TP concentration from the EAA with BMPs implemented | 141 ppb |
| Five-year (WY2009–WY2013) FWM TP concentration | 116 ppb |

¹The baseline period of record is October 1978–September 1988 in accordance with Everglades Forever Act (EFA) requirements. Under Chapter 40E-63, Florida Administrative Code (F.A.C.) compliance is based on whole water year periods (May 1–April 30) that fall within the October 1978–September 1988 range, that is, WY1980–WY1988 (May 1, 1979–April 30, 1988).

Table 4-3 summarizes data for all calculated water years. This table presents observed and predicted TP data and annual rainfall and flow measurements. The TP values presented are attributable only to EAA Basin runoff (farms, cities, and industries) and do not represent the cumulative TP being discharged through the EAA boundary structures from all sources.

Table 4-3. WY1980–WY2013 EAA Basin TP measurements and calculations.

| Water Year | Observed TP Load ¹ (mt) | Predicted TP Load ² (mt) | Percent TP Load Reduction ³ | Annual Rainfall (inches) ⁴ | Annual Flow (10 ³ ac-ft) ⁴ | Annual FWM Concentration (ppb) ⁴ | Baseline and BMP Status Timeline ⁵ |
|-------------------|---------------------------------------|--|--|---------------------------------------|--|---|---|
| 1980 | 167 | 154 | -9% | 53.5 | 1,162 | 117 | Baseline Period |
| 1981 | 85 | 98 | 13% | 35.1 | 550 | 126 | |
| 1982 | 234 | 255 | 8% | 46.7 | 781 | 243 | |
| 1983 | 473 | 462 | -2% | 64.4 | 1,965 | 195 | |
| 1984 | 188 | 212 | 11% | 49.8 | 980 | 155 | |
| 1985 | 229 | 180 | -27% | 39.7 | 824 | 225 | |
| 1986 | 197 | 240 | 18% | 51.2 | 1,059 | 151 | |
| 1987 | 291 | 261 | -12% | 52.0 | 1,286 | 183 | |
| 1988 | 140 | 128 | -9% | 43.4 | 701 | 161 | |
| 1989 | 183 | 274 | 33% | 39.7 | 750 | 197 | |
| 1990 | 121 | 120 | -1% | 40.1 | 552 | 177 | Pre-BMP Period |
| 1991 | 180 | 219 | 17% | 50.4 | 707 | 207 | |
| 1992 | 106 | 179 | 41% | 47.6 | 908 | 94 | |
| 1993 | 318 | 572 | 44% | 61.7 | 1,639 | 157 | Everglades Rule BMPs |
| 1994 | 132 | 160 | 17% | 50.5 | 952 | 112 | |
| 1995 | 268 | 388 | 31% | 67.0 | 1,878 | 116 | |
| 1996 ⁶ | 162 | 503 | 68% | 56.9 | 1,336 | 98 | |
| 1997 | 122 | 240 | 49% | 52.0 | 996 | 100 | |
| 1998 | 161 | 244 | 34% | 56.1 | 1,276 | 102 | |
| 1999 | 128 | 249 | 49% | 43.4 | 833 | 123 | |
| 2000 | 193 | 425 | 55% | 57.5 | 1,311 | 119 | |
| 2001 | 52 | 195 | 73% | 37.3 | 667 | 64 | |
| 2002 | 101 | 227 | 55% | 49.1 | 1,071 | 77 | |
| 2003 | 81 | 125 | 35% | 45.6 | 992 | 66 | |
| 2004 | 82 | 229 | 64% | 46.8 | 961 | 69 | |
| 2005 | 182 | 444 | 59% | 51.0 | 1,190 | 124 | |
| 2006 | 153 | 270 | 44% | 50.1 | 1,035 | 119 | |
| 2007 | 150 | 182 | 18% | 37.2 | 727 | 166 | |
| 2008 | 94 | 167 | 44% | 47.0 | 619 | 123 | |
| 2009 | 129 | 407 | 68% | 43.7 | 877 | 119 | |
| 2010 | 169 | 288 | 41% | 61.9 | 1,079 | 127 | |
| 2011 | 45 | 219 | 79% | 42.0 | 517 | 71 | |
| 2012 | 63 | 217 | 71% | 44.4 | 546 | 93 | |
| 2013 | 154 | 263 | 41% | 53.5 | 884 | 141 | |

¹TP values are attributable only to the EAA Basin (farms, cities, and industries) and do not represent the cumulative TP being discharged through the EAA boundary structures from all sources such as Lake Okeechobee and the 298 Districts.

²Predicted TP load represents the baseline period load adjusted for rainfall variability.

³Percent TP load reduction values for WY1980–WY1988 represent the compliance model calibration period. BMP – best management practice

⁴1 inch = 2.54 cm, 10³ ac-ft = thousands of acre-feet, 1 acre-foot = 1,233.5 cubic meters and 1 ppb = 1 µg/L.

⁵Dashed vertical line indicates the period for which BMPs were not fully implemented from WY1992 to WY1995.

⁶1996 was the first year of compliance measurement for the EAA Basin.

The EAA Basin percent TP load reduction trend is presented in **Figure 4-3**. The solid line shows the five-year trend of percent load reduction. The diamond (♦) symbol represents the annual measurements. An upward trend in the solid line in **Figure 4-3** denotes a reduction in loads; that is, an overall long-term improvement in the water quality of EAA Basin runoff discharges.

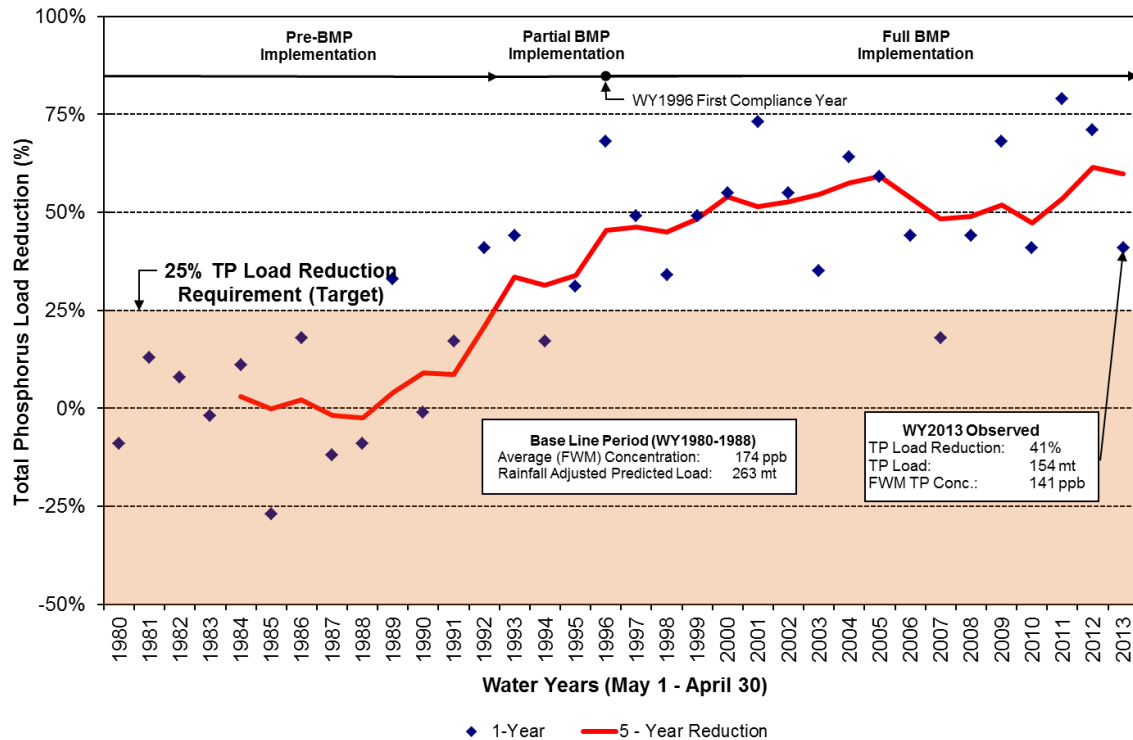


Figure 4-3. EAA Basin percent total phosphorus (TP) load reduction trend with period of record comparisons. [Note: BMP – Best Management Practice, Conc. – concentration; FWM – flow-weighted mean; mt – metric ton; ppb – parts per billion.]

Supplemental evaluation of the EAA data at the basin, sub-basin, and permit level is presented in Appendix 4-2 of this volume. The supplemental evaluation includes compliance calculation details, monitoring data and a water quality summary, discussion of short-term and long-term variations in basin loads, cumulative load reductions, permit-level data, and agricultural privilege tax incentive credit information.

EAA Basin Source Control Strategy

The source control strategy for the EAA Basin primarily relies on an EFA-mandated regulatory program for BMP implementation for which compliance determinations began in WY1996. Chapter 40E-63, F.A.C., requires a permit for a BMP plan for each crop or land use within each sub-basin or farm. In addition, through an adaptive management process, the regulatory program ensures that mandatory BMP implementation and performance measures continue to be applicable in response to regional changes.

The BMP plans are comprehensive; they address both nutrient input to the system and transport from the system and generally consist of nutrient management, water management, and sediment controls. Changes to the BMP plans require the District's approval. Permittees are also

required to collect water quality and quantity data at farm discharges (permit level) through approved discharge monitoring plans. [Refer to the 2009 SFER – Volume I, Appendix 4-1 for more information on comprehensive BMP plans and BMP plan examples, and each subsequent annual SFER Volume I, Appendix 4-2 for permit-level water quality and quantity data.] Water quality data collected at the permit level are used as general indicators of individual BMP plan performance and used as a secondary means of compliance if the EAA is not in compliance at the basin level, but cannot be related directly to individual BMPs or considered in isolation of other potential factors affecting performance.

The original guidance document for BMP design and plan implementation in the EAA is the Procedural Guide for the Development of Farm-Level Best Management Practice Plans for Phosphorus Control in the EAA, Version 1.1, developed by the UF/IFAS (Bottcher et al., 1997). Additional research has been conducted to improve BMP effectiveness and design by the University of Florida Institute for Food and Agricultural Sciences (UF/IFAS) pursuant to the EFA and Chapter 40E-63, F.A.C., requirements and via the EAA – Everglades Protection District (EAA–EPD) Master Research Permit. Investigation to improve the selection, design criteria, and implementation of BMPs is ongoing. Updates to documentation for individual BMPs are available at <http://edis.ifas.ufl.edu>. Searching this site for “EAA BMP” provides documents including design criteria for construction (as applicable), operation of BMPs, and farm management applicable to the EAA. The District refers to these updated technical sources when conducting BMP field verifications and advising permittees on revising BMP plans. The update on source control activities below describes the current investigations to enhance the body of knowledge on BMPs in the EAA. The District’s current emphasis is on working cooperatively with the EAA–EPD to continue the floating aquatic vegetation (FAV) research approved through a 2010 scope of work modification.

In addition to the EAA–EPD research, BMP research is conducted by individual consultants for the EAA–EPD outside the oversight of the permit by individual landowners, other agencies, or the UF/IFAS. Results from these research projects can result in recommendations to adjust BMP implementation, but consideration is given to site-specific conditions on a farm-by-farm basis.

As indicated in the UF/IFAS procedural guide, the industry definition for a BMP is an “on-farm operational procedure designed to reduce phosphorus losses in drainage waters to an environmentally acceptable level” (Bottcher et al., 1997). Based on Chapter 40E-63, F.A.C., permittees are required to revise their BMP plan to enhance performance if the basin as a whole is not in compliance and the secondary performance measure at the individual farm level is not met. However, since the EAA Basin has been in compliance with required phosphorus loading levels, implementation of more effective BMP practices has not been mandatory.

In addition, the strategy in the EAA Basin includes supplemental source control projects for maintaining or improving the current level of performance. The District conducts upstream data collection at tributaries and supplementary analyses of nonagricultural and agricultural sources with the potential to affect basinwide performance to determine the most effective source control strategies. Cooperation of landowners and other interested parties is necessary for the successful implementation of source controls beyond those required by the regulatory program.

EAA Basin Source Control Activities

During WY2013, the District implemented the ongoing EFA-mandated regulatory BMP program and made progress on supplemental projects as listed below.

Water Year 2013 Activities

- **BMP Regulatory Program.** At the end of WY2013, 467,442 acres were under Everglades Works of the District (WOD) permits in the EAA. Post-permit compliance activities continued in these farm basins through on-site BMP verifications. BMP verifications were prioritized based on farm location, water quality history, size, and date of previous verification. The permit renewal process started in March 2012 and was completed in December 2012.
- **298 District and 715 Farms Diversion Projects.** Prior to calendar year 2001, the diversion areas discharged exclusively to Lake Okeechobee and therefore were not part of the EAA baseline period. Since 1992, landowners within these areas were collectively permitted under Chapter 40E-61, F.A.C., via the Lake Okeechobee Surface Water Improvement and Management Plan Master Permit. From 2001 to 2005, diversion projects were completed to direct most of the flows from these areas to the south for treatment in STAs and discharge to the EPA. These basins are within an area of overlap between the Northern and Southern Everglades source control programs and therefore must achieve nutrient discharge requirements of both the Lake Okeechobee and the ECP. Defining a separate method for evaluating the impact of BMPs on TP loads in these relatively recent tributaries (diversion areas) to the EPA is required because load reductions from these areas are not included in the EAA performance measure methodology adopted under Chapter 40E-63, F.A.C. Two phosphorus reduction performance goals continue to be in effect for discharges from these areas: reduce overall TP loads by 25 percent, and reduce TP loads to Lake Okeechobee by 80 percent compared to historical levels. Technical and regulatory details are being developed to implement a performance measure for these areas consistent with the EAA source control program. The District's regulatory plan, which was filed with the Office of Fiscal and Regulatory Reform, was updated to include proposed amendments to Chapter 40E-63, F.A.C. for this purpose.
- **West Palm Beach Canal Data Collection.** A canal water quality and flow data collection effort is underway within the West Palm Beach Canal (see **Figure 4-2**). The objective is to further the understanding of phosphorus sources, transport mechanisms, and sinks affecting TP loading from the EAA at the sub-basin level. This knowledge is expected to help in refining source control initiatives.
- **BMP Research.** In addition to the regulatory program, the EFA, Chapter 40E-63, F.A.C. and Chapter 40E-61, F.A.C., require EAA landowners, through the EAA-EPD, to sponsor a program of BMP research, testing, and implementation that monitors the efficacy of established BMPs in improving water quality in the EPA. The master permit for BMP research, testing, and implementation is the mechanism through which the District implements research and outreach requirements. Meaningful findings that can be incorporated into agricultural practices are essential to meet and maintain the performance goals of the ECP and to optimize the regulatory program. The master permit is issued to the EAA-EPD, and research is conducted by the UF/IFAS in Belle Glade. The last permit modification was approved in January 2010 and is valid for 5 years. The approved scope of work focuses on the management of FAV. The main objectives of the research are to (1) evaluate the impact of alternate management practices for the control of FAV in EAA farm canals on farm TP load, and (2) develop improve BMP techniques

for FAV management for use in the EAA. The activities under the EAA–EPD master permit for WY2013 were as follows:

- BMP training workshops were conducted in September 2012 and April 2013 for growers in the EAA with a total of 240 participants. Feedback received via evaluations collected after training workshops was positive and was used to modify and improve training topics, content, and speaker selections. The BMP workshop presentations can be found at the following website: http://erec.ifas.ufl.edu/research/index_soil_and_water.shtml.
- Under the research project, the following activities have been conducted: (1) bathymetric surveys of main farm canals (November 2012 and April 2013); (2) sediment analyses of main farm canals (November 2012 and April 2013); (3) ambient main canal and drainage water quality monitoring by biweekly grab samples for total phosphorus, total dissolved phosphorus, particulate phosphorus, dissolved organic phosphorus, total suspended solids, total dissolved calcium, and pH; (4) bimonthly qualitative and quantitative assessment of FAV biomass from each main farm canal; (5) flow composite sampling of farm drainage water collected and analyzed for every drainage event; (6) monitoring of farm canal drainage flow rates, canal elevations, rainfall, and estimation of farm drainage water velocities during drainage events; and (7) a soil depth survey on all eight farms to evaluate the average thickness of soils on farmland. In addition, the UF/IFAS uses in-situ Hydrolabs to monitor canal water temperature, conductivity, and pH.
- The two-year calibration period ended April 30, 2013. A statistical comparison of the farm pairs was completed and treatment and control farms were selected for three locations. The treatment phase for three pairs of farms began in May 2013. The results of the calibration will be reported in the 2013 UF/IFAS annual report.

Anticipated Activities

- **BMP Regulatory Program.** The District's post-permit compliance activities will continue. BMP verifications will be prioritized based on farm location, water quality history, size, and date of previous verification.
- **298 District and 715 Farms Diversion Projects.** The District plans to align efforts with the Northern Everglades and Estuaries Protection Program (NEEPP) for the overlapping Lake Okeechobee Watershed. Through a stakeholder public participation process, the District plans to continue to develop technical and regulatory details and adopt a performance measure for these areas consistent with the EAA source control program while ensuring consistency with Lake Okeechobee water quality goals associated with the NEEPP.
- **West Palm Beach Canal Data Collection.** A canal water quality and flow data collection effort, as described above will continue within the West Palm Beach Canal.
- **BMP Research.** The EAA–EPD will continue research and documentation on phosphorus loading from EAA farms based on improved FAV and canal management practices. Also, the EAA–EPD will continue to conduct BMP training workshops. The following activities are being proposed for calendar years 2013 and 2014: (1) sediment analyses for all eight study farms will be conducted in November and April, (2) biweekly sampling of ambient canal and drainage waters, (3) survey and composition analysis every two months of FAV biomass, (4) treatment farms will be inspected every two weeks and FAV will be spot sprayed for complete control of its growth, (5) two BMP

training workshops, and (6) an annual report and presentation at the EAA-EPD Landowners Annual Meeting.

- **Statistical Analysis of Permit Level Data.** An update of existing Statistical Analysis Software (SAS) code along with an update of the statistical analysis for long-term trends, seasonality, and statistical outliers for WY1995 through WY2013 for all EAA Farms is being performed. The project will also document the process for incorporating future water year data to the statistical analysis utilizing the updated SAS tools.

C-139 BASIN UPDATE

During WY2011, amendments to rules within Chapter 40E-63, F.A.C., were adopted to provide for a more comprehensive and effective source control program. The amended rule includes requirements for implementation of all defined categories of BMPs (nutrient management, water management, and sediment controls) for all properties, as applicable. Although basin performance has been computed and reported annually since then, WY2013 is the first water year of compliance determination for which water quality improvement activities could be required under the amended rule. Representative monitoring locations for determining WY2013 TP load performance are shown in **Figure 4-4**.

Water Year 2013 Phosphorus Results

The TP load discharged from the C-139 Basin was below the predicted load from the pre-BMP baseline period adjusted for rainfall. **Table 4-4** provides a summary of the C-139 Basin WY2013 results for the observed and performance measure TP loads in metric tons. The observed load is based on flow and water quality data measured during the water year. The target load is pre-BMP baseline period load predicted considering the current water year rainfall characteristics. The target load applies a base period regression model to the current water year rainfall characteristics to account for the hydrologic variability between WY2013 and the base period. The target load model was developed to meet the EFA requirement of maintaining pre-BMP baseline period loading rates. Target and limit loads are evaluated as described in the *Everglades Agricultural Area Basin Update* section above. Details of target and limit load calculations and performance evaluation can be found in Appendix 4-2 of this volume and Chapter 40E-63, F.A.C. **Table 4-4** also summarizes TP concentrations in parts per billion.

Table 4-4. Results of WY2013 C-139 Basin TP performance calculations.

| TP Load | |
|--|---------|
| Target (predicted) TP load (adjusted for WY2013 rainfall amounts and monthly distribution relative to the baseline period ¹) | 22 mt |
| Limit TP load (upper 90 th percentile confidence level for target load) | 55 mt |
| Observed WY2013 TP load from the C-139 Basin with full implementation of Comprehensive BMP Plans | 10 mt |
| TP Concentration | |
| Observed C-139 Basin flow-weighted mean (FWM) TP concentration prior to BMP implementation (WY1980–WY1988) ¹ | 235 ppb |
| Observed WY2013 FWM TP concentration from the C-139 Basin with full implementation of Comprehensive BMP Plans | 116 ppb |
| Five-year (WY2009–WY2013) FWM TP concentration | 183 ppb |

¹The baseline period of record is October 1978–September 1988 in accordance with Everglades Forever Act (EFA) requirements. Under Chapter 40E-63, Florida Administrative Code (F.A.C.) compliance is based on whole water year periods (May 1–April 30) that fall within the October 1978–September 1988 range, that is, WY1980–WY1988 (May 1, 1979–April 30, 1988).

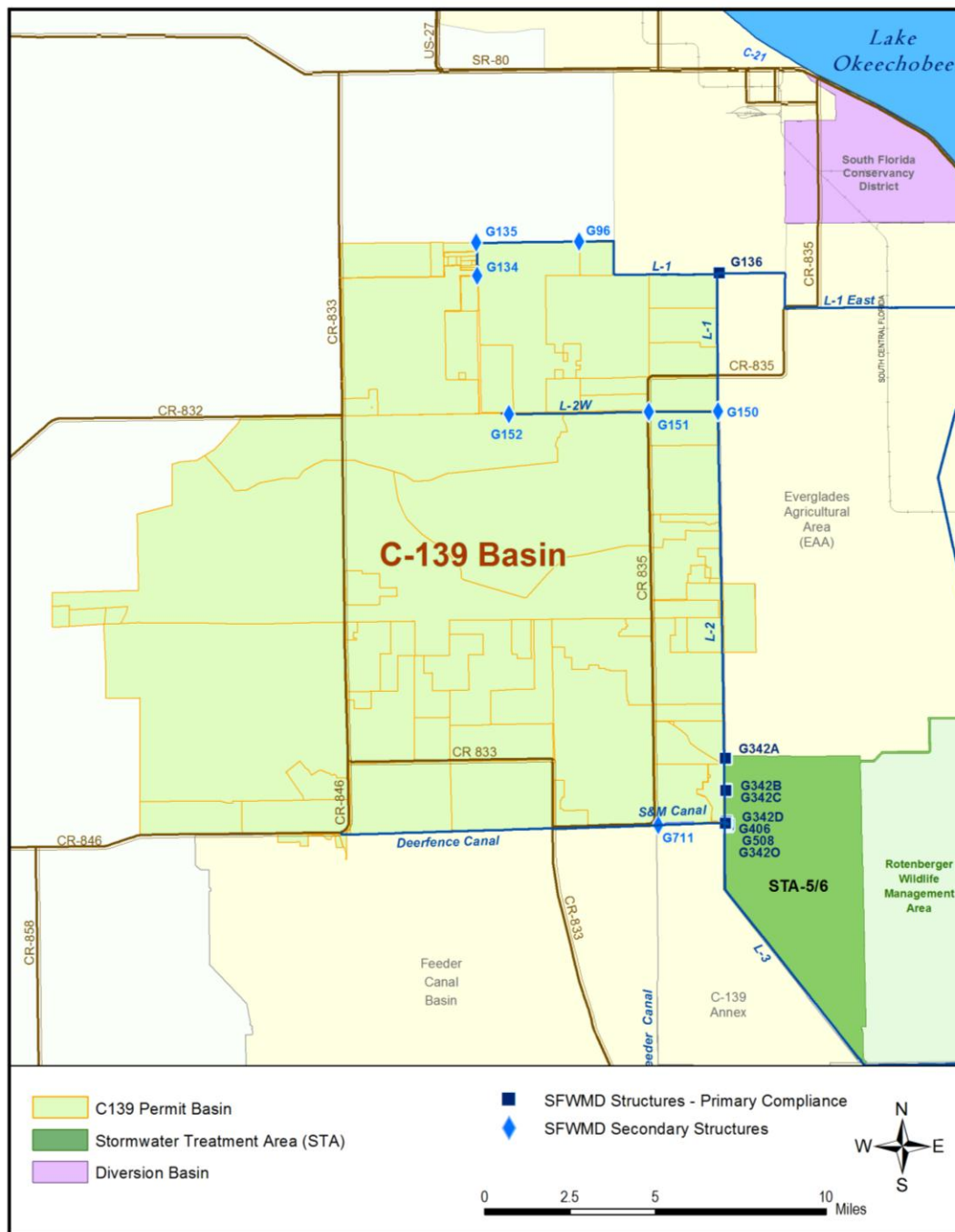


Figure 4-4. WY2013 C-139 Basin boundary and primary compliance water control structures.

Chapter 40E-63, F.A.C., allows for the option of a permit-level discharge monitoring plan to be considered as a secondary performance methodology should the C-139 Basin be determined to not meet overall load performance. None of the permits issued to date include an optional discharge monitoring plan; therefore, only C-139 Basin-level data are reported in this chapter.

Supplemental evaluation of the C-139 Basin data is presented in Appendix 4-2 of this volume. The supplemental evaluation includes performance calculation details, monitoring data, and a water quality summary, as well as a discussion of short-term and long-term variations in basin loads. Individual structure flows, related TP loads, and FWM concentrations are also presented as an aid to focus BMP source control efforts.

Table 4-5 summarizes data for all calculated water years. This table presents observed and predicted TP data and annual rainfall and flow measurements. The TP values presented in the table are attributable only to the C-139 Basin. **Figure 4-5** shows trends in TP loads and associated targets and limits since WY2003. The TP values presented in this figure are attributable only to the C-139 Basin.

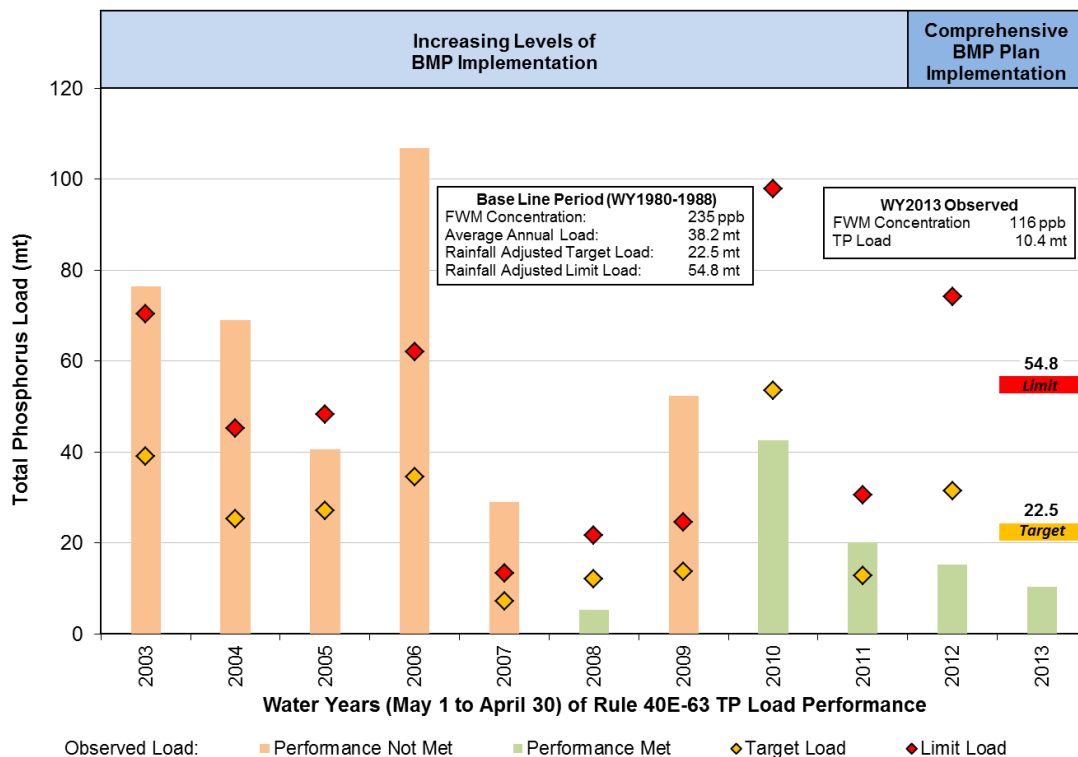


Figure 4-5. C-139 Basin TP load results.

Table 4-5. WY1980–WY2013 C-139 Basin
TP measurements and calculations.

| Water Year | Observed TP Load ¹ (mt) | Predicted TP Load ² (mt) | Annual Rainfall (inches) ³ | Annual Flow (10 ³ ac-ft) ³ | Annual FWM Concentration (ppb) ³ | Baseline and BMP Status Timeline | |
|------------|---------------------------------------|--|--|---|--|---|--|
| 1980 | 37 | 42 | 56.4 | 172 | 173 | Baseline Period | |
| 1981 | 4 | 4 | 31.1 | 51 | 69 | | |
| 1982 | 6 | 9 | 38.6 | 44 | 120 | | |
| 1983 | 154 | 115 | 72 | 345 | 363 | | |
| 1984 | 41 | 20 | 47.2 | 156 | 215 | | |
| 1985 | 15 | 20 | 46.9 | 63 | 195 | | |
| 1986 | 18 | 19 | 46.7 | 110 | 129 | | |
| 1987 | 38 | 55 | 60.2 | 149 | 208 | | |
| 1988 | 29 | 22 | 48 | 94 | 252 | | |
| 1989 | 15 | 11 | 40.7 | 73 | 163 | | |
| 1990 | 6 | 10 | 39.6 | 46 | 102 | Pre-BMP Period | |
| 1991 | 5 | 21 | 47.5 | 45 | 93 | | |
| 1992 | 13 | 28 | 51 | 100 | 104 | | |
| 1993 | 27 | 39 | 55.5 | 137 | 162 | | |
| 1994 | 23 | 30 | 52 | 137 | 134 | | |
| 1995 | 65 | 54 | 59.8 | 272 | 194 | | |
| 1996 | 48 | 55 | 60.1 | 236 | 164 | | |
| 1997 | 46 | 40 | 55.7 | 165 | 226 | | |
| 1998 | 36 | 43 | 56.6 | 170 | 170 | | |
| 1999 | 36 | 30 | 51.4 | 136 | 212 | | |
| 2000 | 52 | 36 | 54.4 | 202 | 210 | Increasing BMP Implementation Refer to Table 4-6 | |
| 2001 | 17 | 6 | 35.6 | 57 | 245 | | |
| 2002 | 66 | 36 | 53.5 | 200 | 267 | | |
| 2003 | 76 | 39 | 54.6 | 224 | 276 | | |
| 2004 | 69 | 25 | 49.1 | 204 | 274 | | |
| 2005 | 41 | 27 | 50 | 168 | 197 | | |
| 2006 | 107 | 35 | 54.8 | 333 | 260 | | |
| 2007 | 29 | 7 | 36.2 | 77 | 305 | | |
| 2008 | 5 | 12 | 41.6 | 39 | 113 | | |
| 2009 | 52 | 14 | 43 | 165 | 256 | | |
| 2010 | 43 | 54 | 59.8 | 202 | 171 | | |
| 2011 | 20 | 13 | 41 | 106 | 154 | | |
| 2012 | 15 | 32 | 44.5 | 78 | 159 | | |
| 2013 | 10 | 22 | 49.9 | 73 | 116 | | |

¹ TP values attributable only to the C-139 Basin.² Predicted TP load represents the baseline period load adjusted for rainfall variability. For WY1980–WY2010 Rule 40E-63, Florida Administrative Code (F.A.C.) January 2002, and for WY2011–WY2013 Amended Rule 40E-63, F.A.C., November 2010.³ 1 inch = 2.54 cm, 10³ ac-ft = thousands of acre-feet, 1 acre-foot = 1,233.5 cubic meters and 1 ppb = 1 µg/L.

C-139 Basin Source Control Strategy

The C-139 Basin source control strategy primarily relied on the EFA-mandated regulatory program with increasing levels of BMP implementation based on compliance status with basin phosphorus load levels (targets and limits). However, the C-139 Basin was unable to meet the historical phosphorus load levels for the first four consecutive years of WY2003 to WY2006. In response and as required by rule 40E-63.460(3)(d), F.A.C. (2002), a rulemaking process to amend Part IV of Chapter 40E-63, F.A.C., was initiated in 2007 and completed in 2010. BMP implementation levels and compliance actions since program inception (including the rulemaking process) are summarized in **Table 4-6**.

Table 4-6. WY2003–WY2013 C-139 Basin BMP implementation summary.

| Compliance Water Year | BMP Level ¹ | Met Performance | Compliance Action |
|-----------------------|---|------------------|-----------------------------------|
| WY2003 | Initial Implementation of Level I – 15 points | No | Go to Level II Implementation |
| WY2004 | Implement Level II – 15 points with BMP site verifications | No | Go to Level III Implementation |
| WY2005 | Implement Level III – 25 points with BMP site verifications | No | Go to Level IV Implementation |
| WY2006 | Implement Level IV – 35 points with BMP site verifications | No | Initiate Rule Development |
| WY2007 | Continue Level IV | No | Continue Rule Development Process |
| WY2008 | Continue Level IV | Yes | Continue Rule Development Process |
| WY2009 | Continue Level IV | No | Continue Rule Development Process |
| WY2010 | Continue Level IV | Yes | Continue Rule Development Process |
| WY2011 | Comprehensive BMP Plan | Yes ² | Initiate Comprehensive BMP Plans |
| WY2012 | Comprehensive BMP Plan | Yes ² | Comprehensive BMP Plans |
| WY2013 | Comprehensive BMP Plan | Yes ³ | Comprehensive BMP Plans |

¹ Increasing BMP levels/points correspond to increased source control implementation.

² WY2011 and WY2012 performance is shown for reference only. Initial Performance Measure Determination Period under amended methodology set forth in amended Chapter 40E-63, Florida Administrative Code (F.A.C.), is WY2013.

³ First Water Year of performance determination under amended Chapter 40E-63, F.A.C.

The implementation of the mandatory BMP program revealed basin-specific constraints that needed to be considered for the program to be effective. In order to develop solutions to these challenges, the District conducted technical investigations that included water quality analyses, hydrology evaluations, and demonstration projects.

Also, the District has (1) cost-shared implementation of higher cost technologies, (2) implemented a water quality monitoring network, (3) conducted integrated regulatory approaches with consumptive water use and stormwater management system permitting groups within the agency, (4) enhanced stakeholder interaction and outreach, and (5) contracted modeling [i.e., Watershed Assessment Model (WAM)] to evaluate the feasibility and TP reductions of BMPs and source control infrastructure projects.

The results from the activities conducted above and lessons learned from the regulatory program were incorporated into the rule (adopted on November 9, 2010), for a more comprehensive and effective program. The amended rule includes requirements for implementation of all defined categories of BMPs (nutrient management, water management, and sediment controls) for all properties, as applicable. A comprehensive BMP plan will serve to control the different types of phosphorus species (particulate or dissolved), sources, and off-site transport mechanisms.

In addition, the District continues keeping close track of BMP implementation by conducting annual field verifications to permitted areas to consistently achieve compliance with required phosphorus levels in the long term. The field inspections allow the District to discuss BMP strategies and optimizations of current BMP practices with permittees.

Since permittees in the C-139 Basin are not required to collect water quality and quantity data to characterize farm-level discharges, the water quality and quantity monitoring network for upstream areas will be used by the District to differentiate the relative contribution of the hydrologic sub-basins within the C-139 Basin, the timing of releases, and phosphorus species. This information is crucial for developing effective source control strategies into the future. This sub-regional monitoring and data analysis will support water quality improvement activities in case the latest rule amendments are insufficient to achieve consistent compliance with the EFA requirements.

C-139 Basin Source Control Activities

Water Year 2013 Activities

During WY2013, the District implemented the ongoing EFA-mandated regulatory BMP program and made progress on supplemental projects as listed below.

- **BMP Regulatory Compliance Program.** At the end of WY2013, 162,777 acres (28 permits) were under WOD phosphorus permits in the C-139 Basin. On-site BMP verifications were conducted for 99 percent of the total permitted acreage. Post-permit compliance activities continue in these areas through on-site BMP verifications. A total of 24 permits covering 160,578 acres were inspected in WY2013.
- **C-139 Basin Vegetable Production Demonstration Project.** This project evaluated the effects of alternate phosphorus fertilizer application rates, moderation of soil pH using sulfur, use of fertigation and foliar application methods for phosphorus, and use of sulfur and polymer coated fertilizers on crop productivity. In addition, a comparison of sequential analysis and soil test analyses with multiple extractants was made to determine the proper soil test extractant to use in soils with high calcium concentration and pH. The final report summarizing all six years was finalized in September 2012. The project found the following general findings for thirteen tomato evaluations and twelve green bean evaluations (findings for other crops are not discussed due to the limited sample): (1) On average for the participating lands, the observed optimum total relative yield was between 60 and 90 pounds per acre (lbs/acre) of phosphorus pentoxide (P_2O_5) for tomatoes; (2) For green beans, the yields statistically increased with phosphorus application rates only for one fourth of the evaluations. In those cases, highest yields were observed with rates around the grower typical rate (approximately 50 lbs/acre); and (3) Sequential analysis demonstrated that the current Mehlich 1 soil test method does not extract only phosphorus available for crop uptake, but also phosphorus that has been precipitated out of soil solution and is no longer available to the crop plant. Thus, the University of Florida standard recommendations based on Mehlich 1 method may need to

be adjusted for tomatoes at soil phosphorus levels below 200 milligram per kilogram for high pH and calcium soils.

- **C-139 Basin Monitoring Network.** Eight automatic sampling stations collecting TP concentration and flow data were installed in the C-139 Basin to isolate runoff from the sub-regions identified in the November 2010 revisions to Chapter 40E-63, F.A.C. The data collected during WY2013 are being reviewed to refine data collection and analysis methods.
- **C-139 Basin Dye Tracer Evaluation of Aboveground Impoundments.** The objectives of this project were to (1) conduct a tracer test to evaluate how features (soil, topography, configuration, etc.) affect transport and removal in a typical aboveground impoundment, thus justifying modifications to improve performance, and (2) assess the hydrologic characteristics of a modified aboveground impoundment that better uses existing storage to ensure sufficient detention time. The final reports were submitted to the District in January 2013 and the following recommendations were made: (1) the tracer test results revealed poor hydraulic conditions of the impoundment, but by increasing the retention time and minimizing the dispersion within the impoundment, the phosphorus removal performance could be improved, and (2) historical and recent survey data collected in the modified impoundment indicated that short circuits and areas that do not receive flow exist. However, due to project cost and effort, the consultant recommended that any future tracer study be focused on a subset of the internal cells.
- **BMP Demonstration Grant.** The two funded projects were finished in WY2013. Findings and recommendations for each project are as follows:
 - **Surface Water Optimization.** This two-year study evaluated the water quality treatment effectiveness of structural modifications made to a permitted aboveground impoundment. Results indicated that by constructing internal berms and flowing water through these constructed cells, farm TP concentrations could be reduced by 55 percent on average.
 - **Chemical Precipitation Treatment.** The objective of this project was to demonstrate in the field a practical method to remove phosphorus, in particular, the dissolved fraction, from vegetable farm discharges that may have bypassed previous treatment (aboveground impoundment and tailwater recovery system). Based on the limited data collected (6 events), an average reduction in phosphorus concentration of 60 percent was observed.

Anticipated Activities

Through the rule amendment process, post-permit compliance activities and other supplementary projects that have encouraged awareness, the C-139 Basin has been overcoming the lag between source control implementation and achieving TP loading performance levels. Enhancement of the BMP mandatory program will continue with emphasis on supplementary projects to ensure long-term compliance. Planned activities include the following:

- **Continued Post-permit Compliance Activities.** BMP site verifications are an essential component in this phase of the program to ensure compliance in the long term through consistent and thorough implementation of comprehensive BMP Plans since the rule amendment in 2010. Site inspections will focus on verification of implementation of comprehensive BMP plans based on the lessons learned from previous demonstration projects.
- **Continued Funding of BMP Demonstration Projects.** Based on funding availability, the direction continues to be toward providing regulatory and funding incentives to

spearhead landowner-driven BMP demonstration projects to improve effectiveness. It is the intent to maximize the use of funds available for the greatest basin-wide benefits.

- **Continued Data Collection.** Supplementary water quality and quantity data at the sub-basin level will continue to be used to develop a better understanding of upstream contributions and program effectiveness, and to assist with focused remedial action when necessary.
- **Applying Lessons Learned and Evaluating the Applicability of the Latest Technology.** Technical findings on water quality analysis, hydrology, modeling, and BMP demonstration and research are planned to better understand basin conditions both through adaptive management of regulatory source control program and regional solutions.

OTHER ECP BASIN UPDATES

This section discusses source control efforts in areas other than the EAA and C-139 basins that discharge to the STAs. These include the L-8 and C-51 West basins in east-central Palm Beach County. While a portion of stormwater runoff from each of these basins is discharged either to tide through the S-155A structure to the C-51 East Basin and Lake Worth Lagoon or to Lake Okeechobee, drainage from each of these basins is also discharged, either directly or via an adjacent basin, to Stormwater Treatment Area 1 West (STA-1W) and Stormwater Treatment Area 1 East (STA-1E). The Village of Wellington's Acme Improvement District is one of the sub-basins of the C-51 West Basin. Further background information on these basins can be found in previous SFERs.

C-51 West and L-8 Basins Source Control Strategies and Activities

The District monitors water quality in the C-51 West and L-8 basins to ensure phosphorus loads generated within these basins do not affect the performance of STA-1W and STA-1E. The water quality monitoring programs include monitoring of TP concentration and flows at discharge locations to the C-51 West canal, as required by the Village of Wellington Acme Improvement District's Environment Resource Permit (ERP), and upstream monitoring associated with the Village of Wellington's administered phosphorus source control programs. Appendix 4-3 includes a summary of TP concentration data for the Village of Wellington Acme Improvement District.

The Village of Wellington, in addition to its upstream water quality monitoring program, has been administering numerous phosphorus source control activities within the Acme Basin since WY1998. These activities, which include enforcement of Village of Wellington-enacted phosphorus source control ordinances associated with equestrian activities within the basin, remain ongoing.

The District will continue to monitor water quality data from the C-51 West and L-8 basins and, depending on results, may pursue future water quality monitoring in areas not already monitored.

FUTURE DIRECTIONS FOR THE ECP BASINS

The District is planning several activities for the ECP basins to improve the effectiveness of the regulatory source control programs including BMP site verifications, research and demonstration projects, data collection and sub-regional projects as outlined in the Restoration Strategies Regional Water Quality Plan.

STATUS OF SOURCE CONTROL IN THE NON-ECP BASINS

Steve Sarley, Youchao Wang and Carlos Adorisio

Contributor: Cordella Miessau

BACKGROUND

Six basins that discharge directly to the EPA are not part of the ECP. Five of these basins have discharge structures that are operated and maintained by the District and are permitted by FDEP under the non-ECP permit. These discharge structures and basins are the S-9 and S-9A (C-11 West), G-123 (North New River Canal), S-190 (Feeder Canal), S-140 (L-28), and S-18C, S-332D, and S-174 (C-111). The North Springs Improvement District basin is a non-ECP basin capable of discharging directly to the EPA through a pump structure owned and operated by the North Springs Improvement District, formed pursuant to the provisions of Chapter 298, F.S. The non-ECP basins have historically contributed approximately 12 percent of the TP load to the EPA compared to the 88 percent contributed by the ECP basins. As required by the EFA, these basins have adhered to source control programs and water quality monitoring since WY1998. Specifically, the non-ECP permit requires the implementation of basin-specific WQIPs to ensure progress toward achieving established water quality standards in discharges from each of the non-ECP basins. The WQIPs are consistent with the EFA and include the following source control strategies: (1) voluntary BMPs, (2) training and educational initiatives, (3) cooperative agreements, (4) modification of stormwater management system permits to include water quality and operational criteria, (5) basin-specific regulatory programs, and (6) full integration with ongoing and future Comprehensive Everglades Restoration Plan (CERP) and other local construction projects. The location of the non-ECP basins and the associated structures that discharge into the EPA are depicted in **Figure 4-6**.

WATER QUALITY SUMMARIES

The water quality in non-ECP basin discharges is monitored to track the success of the WQIPs in each basin and to assess progress in achieving established water quality standards. The distribution of loads from the non-ECP basins to the EPA by water year is presented in **Figure 4-7**. As shown in this figure, a total TP load of 15 mt discharged to the EPA from the non-ECP basin structures during WY2013. Appendix 4-3 provides additional information on TP loading to the EPA from the non-ECP basins. TP loads discharged in WY2013 to the EPA from the non-ECP basins WY2013 were 2.8 mt for the C-111 Basin, 3.0 mt for the Feeder Canal Basin, 4.5 mt for the L-28 Basin, and 0.1 mt for the North Springs Improvement District Basin. Discharge to the EPA from the North Springs Improvement District occurred as a result of Tropical Storm Isaac, and represents the only TP load discharged to the EPA from the basin since WY2000. The Village of Wellington Acme Improvement District also discharged 0.2 mt to the EPA to relieve flood conditions resulting from rainfall associated with Tropical Storm Isaac. The North New River Canal basin did not discharge to the EPA during WY2013.

As required by the EFA, the non-ECP permit is expected to be modified to require compliance with the TP limits for the Feeder Canal, L-28, C-111, C-11 West, and North New River Canal basins. This proposed permit requirement resulted from the EFA mandate that discharge limits for long-term compliance permits allowing phosphorus discharges into the EPA be established.

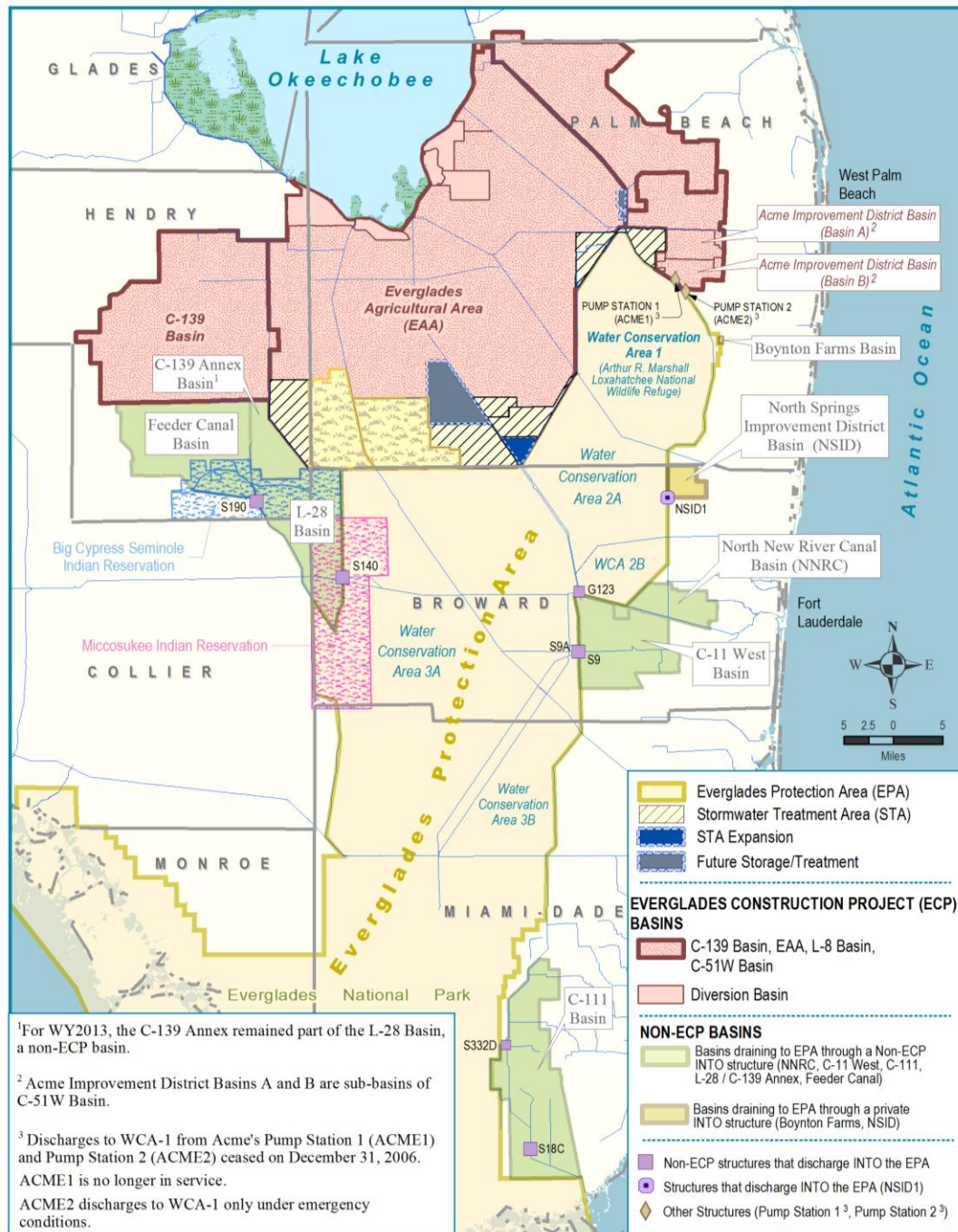


Figure 4-6. The non-Everglades Construction Project (non-ECP) basins and primary compliance water control structures discharging to the Everglades Protection Area (EPA). [Note: WCA – Water Conservation Area.]

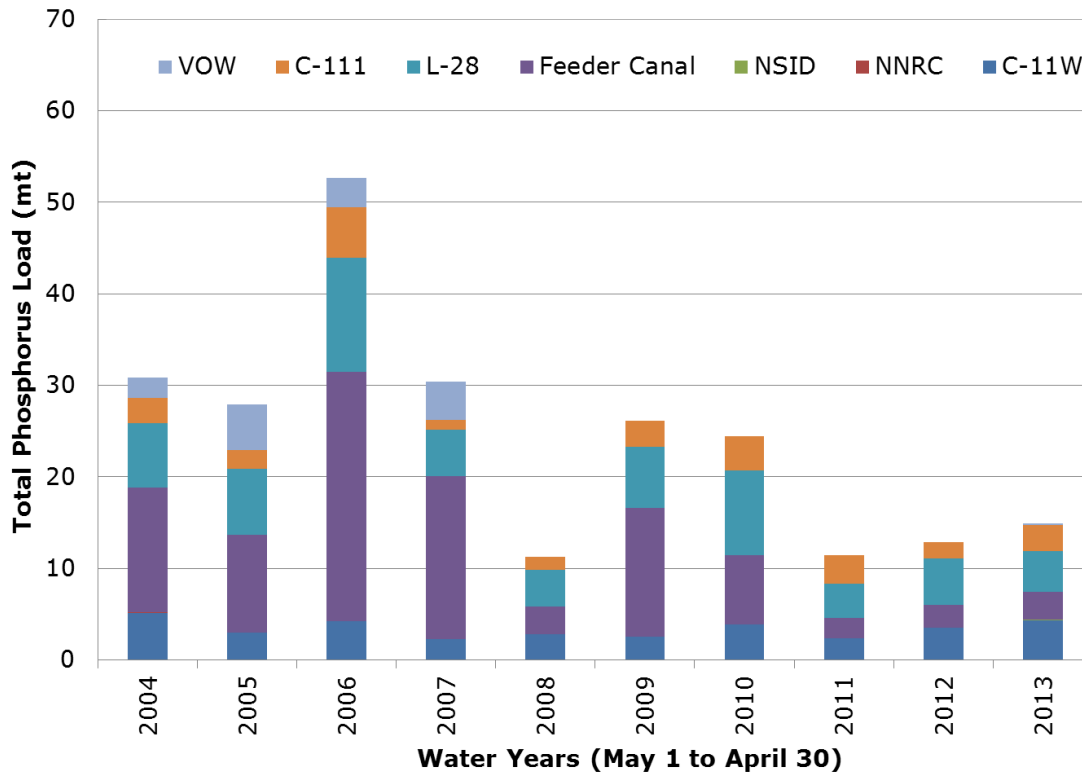


Figure 4-7. Non-ECP basin TP loads into the EPA for WY2004–WY2013.
 [Note: VOW – Village of Wellington, NSID – North Springs Improvement District, NNRC – North New River Canal, C-11W – C-11 West]

SOURCE CONTROL STRATEGIES AND ACTIVITIES

During WY2013, the source control strategies for each of the non-ECP basins continued as summarized below. Additional details on these strategies can be found in previous SFERs.

Feeder Canal Basin

Water Year 2013 Activities

- **Rulemaking.** Statutory changes are necessary before rulemaking can be initiated. The District activities related to the implementation of a regulatory source control program in this basin are currently on hold.
- **Seminole Tribe Water Conservation Plan Project.** The United States Army Corps of Engineers (USACE) is constructing four water resource areas (designated as Basins 1 through 4) designed to improve water quality, restore wetland hydrology, increase water storage capacity, and enhance flood protection within the Big Cypress Seminole Indian Reservation. Basin 1 was completed in August 2008. Construction of Basin 4 started in December 2011 and is expected to be completed in WY2014. Construction of Basin 2 is tentatively scheduled to be awarded in WY2014. Basin 3 is on hold until further notice. The project is sponsored by the Seminole Tribe of Florida.

- **McDaniel Ranch.** Ownership of large portions of this property changed in 2013. All owners are required to continue implementation of BMPs and to operate the surface water management system to ensure appropriate water quality treatment.

Anticipated Activities

- **McDaniel Ranch.** The District expects to continue working with McDaniel Ranch area owners to ensure TP concentrations in basin discharges do not exceed 50 ppb.

L-28 Basin

Water Year 2013 Activities

- **C-139 Annex Activities.** The C-139 Annex property was purchased by the District in October 2010 and was leased back to the previous landowner. The property continues discharging via the USSO structure to the L-28 Borrow Canal and ultimately to the Miccosukee Indian Reservation. The lessee continued implementing BMPs on this property during WY2013. The restoration of the property will be conducted as mitigation for wetland impacts associated with Lake Belt mining in Miami-Dade County, consistent with the goals of the Restoration Strategies Program. As part of this program, a 2,000-acre Flow Equalization Basin is being planned on the north end of this property.
- **L-28 Weir Demonstration Project.** The Miccosukee Tribe of Indians of Florida, in cooperation with the District, designed and constructed this demonstration project, which was completed in September 2009. The objective of the weir construction is to facilitate hydrological restoration of an approximately 8,000-acre area of historical Everglades known as the “Triangle” on the Miccosukee Federal Indian Reservation. It is located on the L-28 Basin south of Interstate 75 between the L-28 interceptor and the L-28 conveyance canals. The project reduces the effects of S-140 pumping activities on the downstream side of the weir and significantly reduces overland drainage effects within the Triangle. The project will facilitate the maintenance of surface water and groundwater within the Triangle to restore hydrology and allow rainfall-driven hydration of the area. Results of the demonstration project will be evaluated by the Tribe and the District through 2015 to assess the hydrologic and environmental changes that result from weir construction and hydroperiod enhancements.

Anticipated Activities

- **C-139 Annex Activities.** The District will further develop the scope of the mitigation plan and implement the Restoration Strategies Regional Water Quality Plan. As part of the mitigation plan, approximately 14,000 acres of the southern end of the property are planned to be restored to historical conditions and it is expected that these areas will be taken out of agricultural production beginning in WY2014.

C-111 Basin

Water Year 2013 Activities

- **C-111 Project.** The District and the USACE are negotiating an agreement that will include plans for the construction of the North Detention Area.
- **C-111 Spreader Canal Western Project.** The project aims to improve water quantity, timing, and distribution in the Southern Everglades and Model Lands, downstream estuaries, and Florida Bay. The project consists of the Frog Pond Impoundment, Aerojet

Canal, plugging of the C-110 and L-31 E canals, and the S-199 and S-200 pump stations. This project was completed in 2012 and dedicated in early 2013.

- **Everglades Restoration Transitional Plan (ERTP) (formerly Combined Structural and Operational Plan).** The District and USACE worked on a new ERTP to supersede the Interim Operational Plan. The ERTP received a signed Record of Decision in WY2013 that provides the authority for it to replace the IOP, modifying current water management operations of the Central and Southern Florida Project in the area.

Anticipated Activities

- **C-111 Project.** The schedule for the North Detention Area Reservoir depends on the terms and conditions of the C-111 Project cooperative agreement.

Broward County C-11 West, North New River Canal and North Springs Improvement District Basins

Water Year 2013 Activities

- **Broward Everglades Working Group.** The District continued its support of Broward County water quality improvement initiatives within the basins through its participation in this working group. The District continued assisting Broward County in revising and implementing the C-11 West Basin Pollution Reduction Action Plan of April 2006, a compilation of C-11 West Basin stakeholder action plans developed to reduce phosphorus discharges to Water Conservation Area 3A (WCA-3A).
- **Broward County Water Preserve Area CERP Project.** This project is expected to significantly reduce flows to WCA-3A and consequently reduce the TP load to WCA-3A (see www.evergladesplan.org/pm/projects/proj_45_broward_wpa.aspx).
- **Central Broward Water Control District Improvements.** The Central Broward Water Control District continues providing public outreach and education.
- **Everglades Website.** Links to the District's Everglades (www.sfwmd.gov/everglades/) and water conservation (www.sfwmd.gov/watersip/) information websites and Broward County's NatureScape website (www.broward.org/NaturalResources/NatureScape/) continue to be provided on the websites of most Broward County stakeholders. Broward County has assisted the District in expanding website link coverage to those Broward County municipality websites that had not previously provided links to District Everglades websites.
- **In-kind Services Supporting Broward County Initiatives for Pollutant Source Control Activities.** The District provided in-kind services in support of Broward County initiatives to educate nursery operators, property managers, landscaping personnel, and residents through "Know the Flow" and "Water Quality" workshops, informational brochures, and coordination with the Palm Beach County Soil and Water Conservation District's mobile irrigation lab to promote its irrigation evaluation services to Broward County nurseries.

Anticipated Activities

- **Broward Everglades Working Group.** The District will continue working with Broward County to expand stakeholder participation in the basins to support Broward County water quality improvement initiatives.
- **In-kind Services Supporting Broward County Initiatives for Pollutant Source Control Activities.** The District will continue to provide in-kind services in support of

Broward County initiatives to educate nursery operators, property managers, landscaping personnel, and residents, and coordination with the Palm Beach County Soil and Water Conservation District's mobile irrigation lab to promote its irrigation evaluation services to Broward County nurseries.

Boynton Farms Basin

Water Year 2013 Activities

- **ERP Program.** Only one property in this basin has the potential to discharge to the EPA and it is owned by Palm Beach County. The District utilized the existing ERP Program to require the remaining landowner to obtain a permit modification issued December 12, 2011, that includes provisions that all discharges from the property will be directed away from the EPA to the Lake Worth Drainage District E-1 canal. Consistent with provisions of the permit modification, all pumps capable of discharging to the EPA were removed from the basin in early 2012.

FUTURE DIRECTIONS FOR NON-ECP BASINS

Continued implementation of the WQIPs for the non-ECP basins, which are consistent with the EFA, is necessary to ensure further progress in improving water quality. The District will continue to track WQIP implementation and work cooperatively with local governments, the Seminole Indian Tribe of Florida, the Miccosukee Tribe of Indians of Florida, and other state and federal agencies to ensure essential components of the WQIPs are completed as scheduled.

The District will continue coordinating with the FDEP for the non-ECP permit renewal process, which will establish long-term compliance permit requirements as well as TP limits. WQIPs, as described and discussed in this chapter and previous SFERs, are expected to progress toward meeting established water quality standards.

OVERVIEW OF NORTHERN EVERGLADES SOURCE CONTROL PROGRAMS

William Baker¹, Steffany Olson and Pamela Wade

In the NEEPP statute, the legislature found that the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds are critical water resources; that watershed changes have resulted in adverse changes to the hydrology and water quality of Lake Okeechobee, and the Caloosahatchee and St. Lucie rivers and their estuaries; and improvement to the hydrology, water quality, and associated aquatic habitats within the watersheds is essential to the protection of the Greater Everglades ecosystem. The NEEPP includes a phased, comprehensive, and innovative protection program composed of integrated approaches to meet these needs: source control programs, construction projects, and research and water quality monitoring programs (**Figure 4-8**).

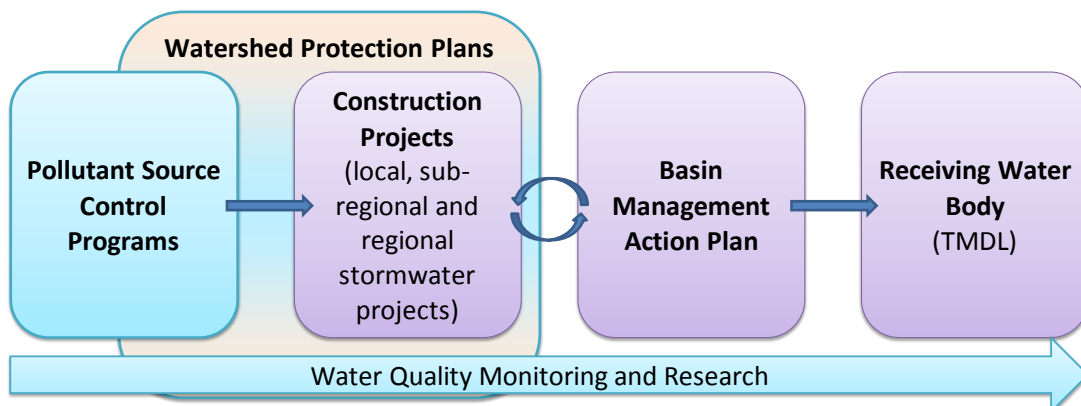


Figure 4-8. Northern Everglades and Estuaries Protection Program (NEEPP) water quality treatment approach. [Note: TMDL – Total Maximum Daily Load.]

This chapter contains the annual progress report for the Lake Okeechobee, Caloosahatchee and St. Lucie River watershed source control programs. Discharge data for phosphorus and nitrogen, as applicable, in runoff from the Northern Everglades sub-watersheds up to WY2013 are provided in Appendix 4-1. Pursuant to the NEEPP, every three years, specified components of the watershed protection plans must be evaluated and any needed modifications identified. The most recent three-year river watershed protection plan updates are found in the 2012 SFER – Volume I, Appendices 10-1 and 10-2. The 2014 Lake Okeechobee Watershed Protection Plan Update is presented in Chapter 8 of this volume.

Additional information on Lake Okeechobee and the river watersheds are found in Chapters 8 and 10 of this volume, respectively.

The District, FDEP, and Florida Department of Agriculture and Consumer Services (FDACS) (the coordinating agencies) are directed by the NEEPP to implement pollutant control programs that are designed to be multifaceted approaches to reducing pollutant loads to the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds. The pollutants of concern in the Northern Everglades are phosphorus in the Lake Okeechobee Watershed and both phosphorus and nitrogen in the river watersheds. The programs include implementation of regulations and

BMPs, development and implementation of improved BMPs, improvement and restoration of the hydrologic function of natural and managed systems, and utilization of alternative technologies for pollutant reduction.

The coordinating agencies perform their responsibilities in concert, through an interagency memorandum of understanding, which was updated in April 2011. The memorandum of understanding establishes the role of each agency in accordance with the statutory authority of the NEEPP. **Table 4-7** identifies the coordinating agency (or other entity), program, and type (non-point or point) of programs in place or being developed to address nutrients in the Northern Everglades. The success of the nutrient control strategies is dependent upon a comprehensive source control approach and consistency between watersheds while factoring in the unique needs and characteristics of each region.

Table 4-7. Nutrient control programs within the Northern Everglades.

| Lead Agency | Program ¹ | Non-Point | Point |
|--|---|-----------|-------|
| South Florida Water Management District (SFWMD) | Works of the District BMP Program ² – Chapter 40E-61, Florida Administrative Code (F.A.C.) | √ | |
| | Environmental Resource Permitting Program – Chapter 373, Florida Statutes (F.S.), Part IV | √ | |
| | Dairy remediation projects ³ | | √ |
| | Dairy Best Available Technologies Project ³ | | √ |
| Florida Department of Agriculture and Consumer Services (FDACS) | Agricultural BMP Program – Chapter 5M-3, F.A.C. | √ | |
| | Animal Manure Application – Chapter 5M-3, F.A.C. | √ | |
| | Urban Turf Fertilizer Rule – Chapter 5E-1, F.A.C. | √ | |
| Florida Department of Environmental Protection (FDEP) | Dairy Rule/Confined Animal Feeding Operation (CAFO) – Chapter 62-670, F.A.C. | | √ |
| | Environmental Resource Permitting Program – Chapter 373, F.S. Part IV | √ | |
| | Stormwater Infrastructure Updates and Master Planning – Chapter 187, F.S. | √ | |
| | Municipal Separate Storm Sewer System Permit Program – Chapter 62-624, F.A.C. | | √ |
| | Comprehensive Planning – Land Development Regulations – Chapter 163, F.S. Part II | √ | |
| | Biosolids Rule – Chapter 62-640, F.A.C. | √ | |
| Florida Department of Health (FDOH) | Application of Septage – Section 373.4595, F.S. | √ | |
| University of Florida Institute of Food and Agricultural Sciences ⁴ (UF/IFAS) | Florida-Friendly Landscaping™ Program – Section 373.185, F.S. | √ | |

¹ Applicable to all three watersheds except where noted in the other footnotes below.

² The rule currently applies to the Lake Okeechobee Watershed. However, as directed by the Northern Everglades and Estuaries Protection Program (NEEPP), the rule will be amended to include the river watersheds.

³ Applicable to only the Lake Okeechobee Watershed.

⁴ Partially funded by the Florida Department of Environmental Protection (FDEP).

While nutrient control programs within the Northern Everglades include point and nonpoint source control programs, the focus of this chapter is the implementation of the nonpoint source control BMP programs implemented by the District and FDACS in the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds through mandated and cooperative efforts, respectively. Regulatory source control programs have historically been demonstrated as the foundation for cost-effective strategies for reducing nutrient loads in runoff. The District's existing Works of the District (WOD) program in Chapter 40E-61, F.A.C. was in place prior to the establishment of the NEEPP. The purpose of Chapter 40E-61, F.A.C., is to establish criteria to ensure that the uses of WOD within the watershed are compatible with the District's ability to implement Chapter 373, F.S. Specifically, this program requires users of WOD in the Lake Okeechobee Watershed to reduce phosphorus at the source, which minimizes transport in runoff so that water quality-based limits can be met in downstream receiving bodies as applicable. The program is carried out through issuance of permits approving phosphorus control plans, inspections to verify compliance with permit conditions, monitoring water quality, prioritizing areas of water quality concern, and providing incentives to users of WOD to implement additional water quality improvement activities. Chapter 40E-61, F.A.C., includes performance measures at the parcel-level based on the 1989 Interim Lake Okeechobee Surface Water Improvement and Management Plan (SFWMD, 1989), as described in the District's Technical Publication 81-2 (SFWMD, 1981) (see 2011 SFER – Volume I, Chapter 4, *Status of Source Control in the Lake Okeechobee Watershed* section for further details). The NEEPP directed that the coordinated agency efforts assure the development of BMPs that complement the existing regulatory program and specifies how those BMPs will be implemented and verified.

Utilizing the existing regulatory authority of Chapter 40E-61, F.A.C., the District will build upon previous experience and minimize costs associated with downstream regional treatment systems. Refinements to Chapter 40E-61, F.A.C., however, are necessary to incorporate the supplemental requirements under the NEEPP. The existing Chapter 40E-61, F.A.C., performance measures were developed prior to the establishment of the Lake Okeechobee, Caloosahatchee, and St. Lucie legislative requirements and current understanding on the efficiency of BMPs. The existing performance measures require that each agricultural and nonagricultural discharger meets a concentration limit at the point of discharge from their property. It is through District monitoring of these discharges that water quality problems are detected and addressed by the coordinating agencies. The NEEPP requires the coordinating agencies to institute a reevaluation of the BMPs and make appropriate changes to the rule where water quality problems are detected despite BMP implementation to assure an adaptive management approach to achieving water quality goals. Therefore, the existing performance measure to assess water quality conditions is being revisited thereby enabling the coordinating agencies to meet this objective in a more cost-effective manner and account for the more recent water quality requirements. Consistent evaluation methods are also in development for the river and estuary watersheds.

In addition to the modifications identified above, changes have been identified for Chapter 40E-61, F.A.C., to incorporate NEEPP mandates that modify the boundary of the program through the inclusion of the Upper Kissimmee Sub-watershed, Lake Istokpoga Sub-watershed, Caloosahatchee River Watershed, and St. Lucie River Watershed (**Figure 4-9**), and to address the nutrients of concern for the river watersheds, which include nitrogen as well as phosphorus. **Figures 4-10 through 4-12** present the source control program implementation areas for Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds.

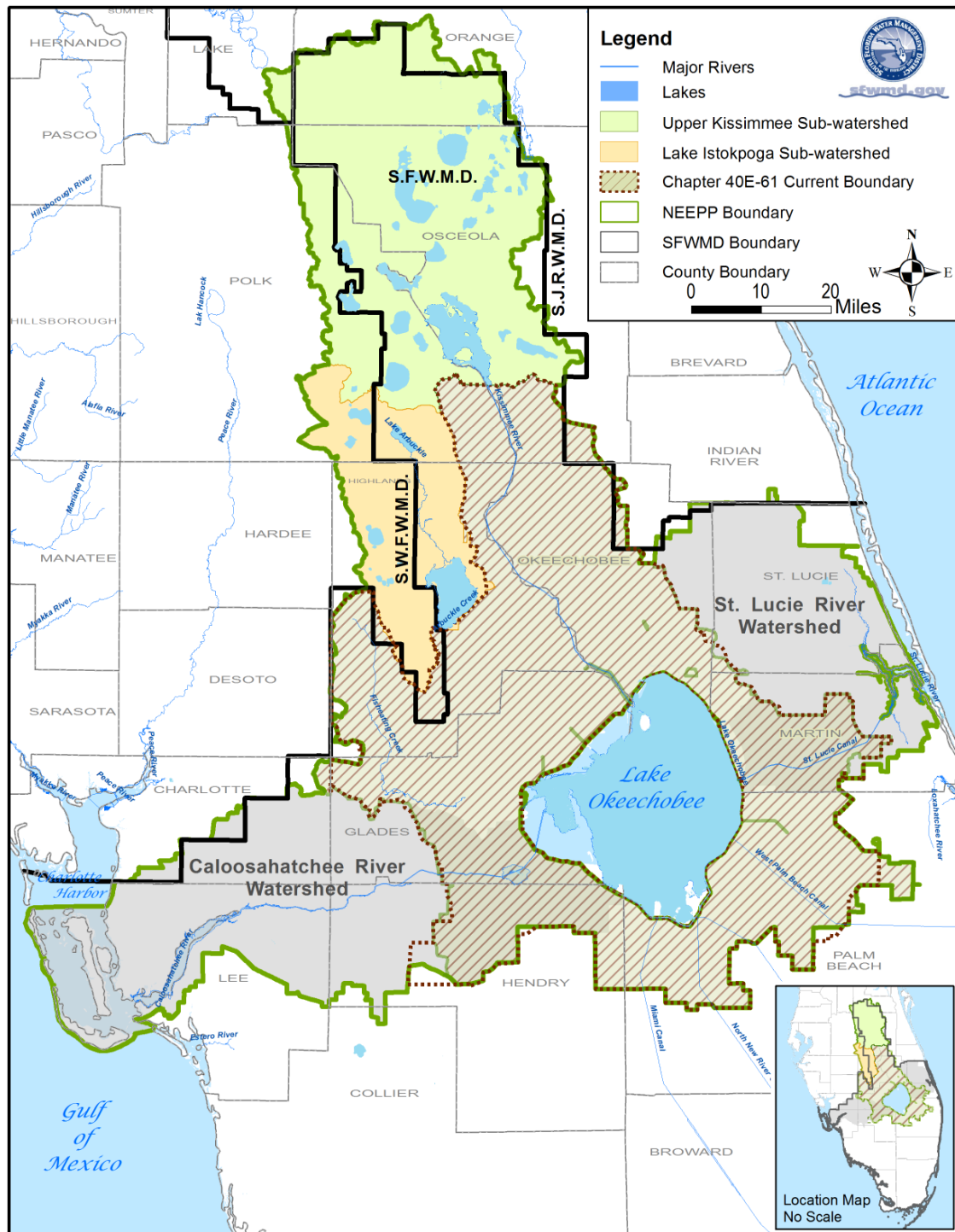


Figure 4-9. Boundary changes resulting from the NEEPP.
 [Note: S.F.W.M.D. – South Florida Water Management District,
 S.J.R.W.M.D. – St. John’s River Water Management District,
 S.W.F.W.M.D. – Southwest Florida Water Management District.]

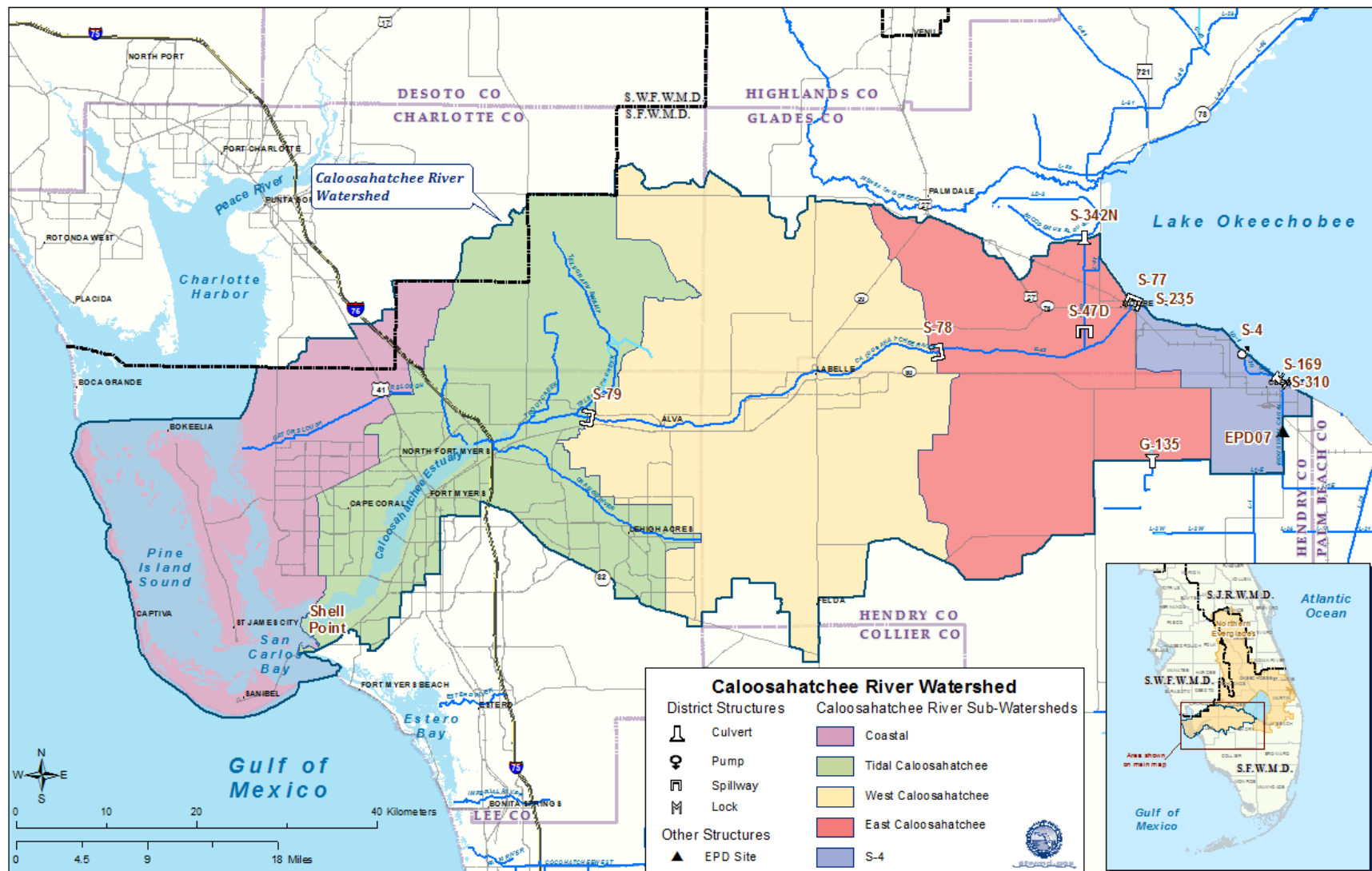


Figure 4-11. Caloosahatchee River Watershed source control program implementation area.
 [Note: CO – county, EPD – Everglades Protection District.]

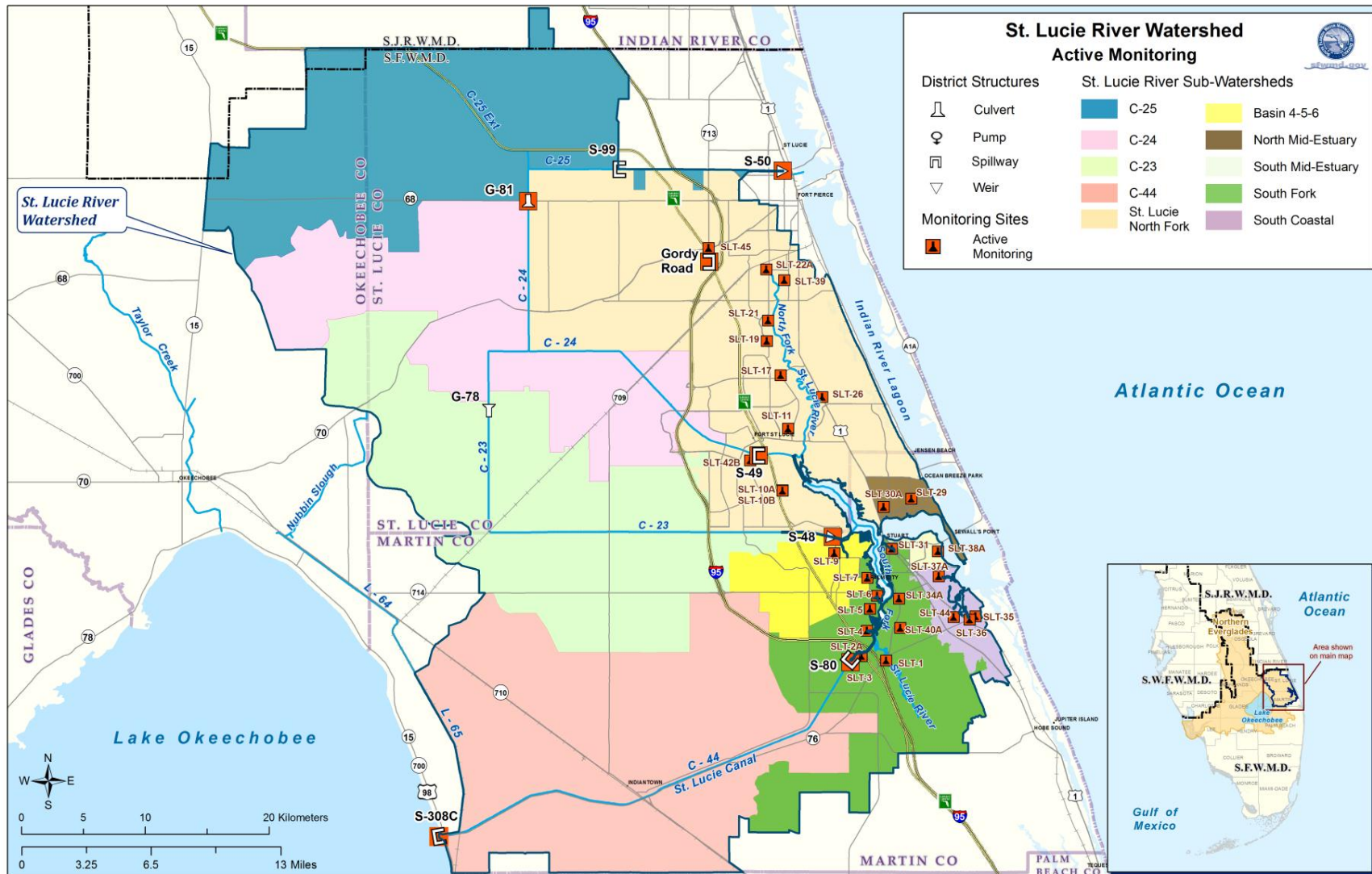


Figure 4-12. St. Lucie River Watershed source control program implementation area.

STATUS OF SOURCE CONTROL IN THE NORTHERN EVERGLADES WATERSHED

Jodie Hansing and Chambal Pandey

Contributors: Steffany Olson, Carmela Bedregal,
Lacramioara Ursu, Bonnie Wolff Pelaez¹ and Clegg Hooks²

BACKGROUND

The coordinating agencies (FDEP, FDACS, and SFWMD) apply complimentary source control strategies across the Northern Everglades watersheds. These strategies primarily consist of the implementation of voluntary BMPs and regulations. The implementation of BMPs for non-point source control of nutrients occurs through the District's Regulatory Nutrient Source Control Program, FDACS BMP Program, and ERP Program implemented by the FDEP or the District. This section and Chapter 8 of this volume provide a three-year update for Lake Okeechobee Watershed Protection Plan and an annual update of the District's and FDACS' source control program for St Lucie and Caloosahatchee Watersheds.

This section focuses on the nonpoint source control programs utilizing BMPs. An update on projects for improvement and restoration of hydrologic function of natural and managed systems, such as the Dispersed Water Management Program, and alternative nutrient reduction technologies are described in the Lake Okeechobee Protection Plan Update in Chapter 8 of this volume.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT NUTRIENT SOURCE CONTROL PROGRAMS

Environmental Resource Permit Program

The District and FDEP are authorized to implement the ERP Program, which requires that new activities or modifications of existing activities provide reasonable assurances that they will not "adversely affect the quality of receiving waters such that state water quality standards will be violated." In the case of the Lake Okeechobee Watershed, as the existing ambient water quality does not meet standards, due to phosphorus impairment, an applicant must implement mitigation measures that are proposed by or acceptable to the applicant that will cause net improvement of the water quality in the receiving waters for those parameters that do not meet standards." Additionally, an applicant must demonstrate that its activities will not cause "adverse water quality impacts to receiving waters or adjacent lands" or "flooding to on-site or off-site properties" (see Rule 62-330.301, F.A.C.). However, not all activities are required to obtain ERPs. For example, certain agricultural activities may be exempt pursuant to Section 373.406, F.S. Other exemptions are set forth in Sections 373.4145(3) and 403.813(1), F.S., and Rule 62-330.051, F.A.C.

The Statewide ERP Rule (SWERP) is scheduled to become effective in WY2014. The legislative mandate for this rulemaking provided that the individual water management districts maintain their existing water quality rules and their ability to promulgate future water quality rules. Therefore, only minor changes were made to the District's water quality rules. These rules will now be set forth in the District's ERP Applicant's Handbook, Volume II. With the regard to the future, water quality rulemaking was included in the SFWMD Regulatory Plan filed in June

² Florida Department of Agriculture and Consumer Services, Tallahassee, FL

2013. It is anticipated that the rulemaking would be limited to an amendment to Part IV of the ERP Applicant's Handbook, Volume II, to codify the existing guidance memorandum on water quality evaluations for discharges to outstanding Florida waters and water bodies that do not meet the state water quality standards.

Regulatory Nutrient Source Control Program

This section provides an update on the District's regulatory nutrient source control program under Chapter 40E-61, F.A.C., Works of the District (WOD) Basins. The program's objective is to ensure that the uses of Works of the District within the watershed are compatible with the District's ability to implement Chapter 373, F.S. The existing rule includes criteria for users of WOD to obtain a WOD permit to implement source control activities, including BMPs, for new and existing agricultural and nonagricultural lands within the Northern Everglades. The rule also prescribes monitoring requirements and a performance methodology for measuring effectiveness in achieving water quality goals. Performance is based on monitoring of TP concentrations in individual users' discharges. Compliance with permit conditions is verified through on-site inspections and records review. In order to address supplemental requirements under the NEEPP, specific initiatives for the District's source control program in the Lake Okeechobee Watershed are as follows:

- Implementation of a phosphorus source control program utilizing BMPs within the Lake Okeechobee Watershed.
- Recognition of agricultural land uses that are participating in the FDACS BMP program under Chapter 5M-3, F.A.C., by a certain deadline as meeting the intent of the District's rule to prevent duplication of effort.
- Establishment of BMP and monitoring requirements for all lands not enrolled in an FDACS BMP program where eligible.
- Definition of the monitoring network necessary to monitor progress, identify priority areas of water quality concern and BMP improvement, and provide data to evaluate and enhance performance of downstream treatment facilities.
- Establishment of a plan for improving the source control programs implemented by the coordinating agencies should the expected water quality goals not be met.
- Assurance that the Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program is consistent with the Lake Okeechobee Watershed Protection Plan (LOWPP).
- Incentives for permittees to participate in TP reduction demonstration projects that will provide valuable data for expanding, accelerating, and improving the implemented BMPs to meet water quality objectives and for further refinement of the Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program as necessary.

The District's main focus in WY2013 was preparing supporting information for rule amendments for the Lake Okeechobee, St. Lucie, and Caloosahatchee River watersheds, and improving the monitoring network to assess future progress toward achieving water quality goals. In addition to the rulemaking activities, staff continued to carry out the core permit and post-permit compliance activities required under Chapter 40E-61, F.A.C., Lake Okeechobee Watershed Assessment (LOWA) monitoring, and implementation of BMPs that would reduce nutrient loads in runoff from District owned leased lands as described in the *SFWMD Water Year 2013 Activities* section below. A breakdown of the acres covered by District source control programs in the Northern Everglades is provided in **Table 4-8**, and maps are provided in Appendix 4-1.

SFWMD Water Year 2013 Activities

BMP Regulatory Program

- The District's core permitting and post permit compliance activities under Chapter 40E-61, F.A.C., are ongoing. Source control permit applications were processed as they were received in accordance with mandated regulatory deadlines, and phosphorus concentration levels within the watershed were evaluated to identify potential areas of water quality concern. Site visits and field scouting were also conducted.
- Monitoring was conducted at Lake Okeechobee Watershed water quality sites identified for tracking progress toward meeting overall water quality goals, which are shown on **Figure 4-10**. Data from these sites is presented in Appendix 4-1 of this volume.
- Monitoring was also conducted at the approximately 100 Lake Okeechobee Watershed Assessment synoptic sites. Data from this monitoring is used by the coordinating agencies to routinely pinpoint areas of concern within basins based on these water quality snapshots. Maps summarizing the monitoring results at these sites are presented in Appendix 4-1.
- For all three watersheds, the District continues to coordinate with the FDACS regarding agricultural BMP enrollment in the relevant FDACS adopted manuals (see <http://www.floridaagwaterpolicy.com> for more information). This requires development of an improved system for tracking the participating agricultural operations and rate of BMP implementation. This system will enable the coordinating agencies to determine consolidated implementation coverage and how it relates to the water quality in discharges from the area. Tests of this system have been conducted in the S-191 and S-133 basins.
- The District is developing a program to improve BMP efficiencies on District-owned lands leased for agricultural uses. Implementation of specific BMPs on District-owned lands is required by the terms of the lease consistent with the intended use of the land. Prospective properties were evaluated based on multiple factors such as, location, past and present land use, size, and lease expiration date. In the Lake Okeechobee Watershed work was begun on a project to install 8 riser culverts on the Grassy Island leased property in the S-191 Basin to retain stormwater runoff and sediments on site. Potential projects are under consideration in the St. Lucie River Watershed.
- Under Chapter 40E-61, F.A.C., the District administers the Lake Okeechobee Management Plan Master Permit. The permit historically required implementation of point and nonpoint phosphorus control activities in the EAA, L-8 and S-4/Industrial Canal basins to reduce the average annual phosphorus loading to Lake Okeechobee by 10 tons in comparison to pre-1989 levels based on modeled results. The future focus of the permit is implementation of nonpoint source controls utilizing BMPs similar to those currently implemented under Chapter 40E-63, F.A.C. and tracking progress through monitoring of discharges. The permit is currently under review for renewal.
- Prior to calendar year 2001, the 298 District and 715 Farms Diversion areas in the EAA discharged exclusively to Lake Okeechobee. Since 1992, landowners within these areas were collectively permitted under Chapter 40E-61, F.A.C., via the Lake Okeechobee Surface Water Improvement and Management Plan Master Permit. From 2001 to 2005, diversion projects were completed to direct most of the flows from these areas to the south for treatment in STAs and discharge to the EPA. These basins are within an area of overlap between the Northern and Southern Everglades source control programs and therefore must achieve nutrient discharge requirements of both the Lake Okeechobee and

the ECP. Technical and regulatory details are being developed for these areas consistent with the EAA source control program. Further details can be found in the *EAA Basin Source Control Activities* section above.

- The District is closely coordinating with the FDEP to ensure that regulatory and protection plan activities are consistent the development of the Basin Management Action Plan (BMAP) for the Lake Okeechobee Watershed, which was initiated by the FDEP in February 2013. In addition, the District participated in the development of the St. Lucie River and Estuary BMAP for total phosphorus (TP) and total nitrogen (TN) (adopted in June 2013) and the Caloosahatchee Estuary BMAP for TN (adopted in November 2012). These BMAPs include phased implementation of point and nonpoint pollution control strategies, such as stormwater BMPs, necessary to achieve the associated TMDLs. The District collaborated in the development of the BMAP model by reviewing model output and nutrient loading analyses, identifying monitoring stations to gauge nutrient and flow trends, and providing hydrologic basin boundaries based on District analyses and stakeholders' input.

Rule Development

- The District's regulatory plan, which was filed with the Office of Fiscal and Regulatory Reform, was updated to include proposed amendments to Chapter 40E-61, F.A.C., and Chapter 40E-63, F.A.C.
- For the Lake Okeechobee Watershed, proposed amendments to Chapter 40E-61, F.A.C., are under development by the coordinating agencies.
- For the Caloosahatchee River Watershed, the development of technical support documentation to support future District rulemaking was substantially completed (Gary Goforth, Inc., 2013).
- For the St. Lucie River Watershed, the District coordinated with local entities (SFWMD, 2013) to refine basin drainage boundary delineations to better align with representative monitoring stations. The revised boundary delineations are shown in **Figure 4-12**.
- For the river watersheds, additional statistical analyses were conducted to consider background nitrogen levels when estimating progress towards achieving water quality goals. The organic component of total nitrogen is primarily found in natural lands that have not been impacted or altered (wetlands, etc.). The inorganic component is primarily introduced to the environment through anthropogenic forms (fertilizers, waste materials, detergents, etc.). Water quality, land use and soil data were analyzed to develop background nitrogen thresholds as a function of the fraction of organic nitrogen in the total nitrogen runoff.
- In support of District rule development for the St. Lucie River Watershed, improvements and additions were made to the monitoring network. Water quality monitoring at twelve additional tributary stations was approved to begin in May 2013. The twelve new stations supplement the existing monitoring network and allow full representation of all land uses in each sub-watershed and gains 75,000 acres of monitored area or 68 percent of the St. Lucie Watershed unmonitored area. Monitoring data from the existing network is presented in Appendix 4-1, which will be supplemented in future reports with data from the twelve new sites. Synoptic water quality and flow monitoring within the St. Lucie C-23 and C-24 sub-watersheds concluded in September 2012. Analysis of the data is under way and will provide a snapshot of nutrient contributions for representative sub-basins within these priority sub-watersheds. The collection of stream gauging flow measurements for St. Lucie Tributary stations continued for the second year. The

additional measured flow conditions will be used to optimize the flow rating curves and improve the historical datasets. All this monitoring has been identified for tracking progress toward meeting overall water quality goals.

SFWMD Anticipated Activities

BMP Regulatory Program

- The District Regulatory Program will continue as described in Chapter 40E-61, F.A.C., including permit processing, field verification of BMP implementation, and water quality assessment. In addition, the District will continue to coordinate with the FDACS regarding tracking the progress of continued enrollment and implementation of agricultural BMPs under all the applicable FDACS-adopted BMP programs.
- Monitoring for the Lake Okeechobee, St. Lucie, and Caloosahatchee River watersheds will continue at the recommended upstream Lake Okeechobee Watershed Assessment sites.

Rule Development

- The rule development process to amend Chapter 40E-61, F.A.C., to encompass Lake Okeechobee, St. Lucie River and Caloosahatchee River watersheds will be initiated in accordance with the NEEPP, the development of the Lake Okeechobee BMAP, and the St. Lucie Watershed and Tidal Caloosahatchee BMAP requirements. The proposed amendments are expected to expand the regulatory watershed boundaries, provide deadlines for the implementation of source controls, specify monitoring to track progress, recognize agricultural lands participating in FDACS programs as meeting the intent of the amended rule, and provide incentives for landowners to participate in nutrient reduction demonstration projects.
- Staff will request approval for rule development for Chapter 40E-61, F.A.C. from the District's Governing Board.
- The proposed amendments to Chapter 40E-61, F.A.C., will be presented to stakeholders in multiple workshops with the goal of rule adoption in 2015.
- For the Caloosahatchee River Watershed, the District will evaluate opportunities to collect data at locations representative of tributary areas in the tidal and coastal sub-watersheds to improve the understanding of nutrient sources for tracking progress towards meeting overall water quality goals.
- The collection of flow measurements for the St. Lucie tributary stations will continue in WY2014. The collected data will be used to improve historical flow data for the period from 2003–2011 to more accurately estimate nutrient loads.

Table 4-8. Acres of SFWMD-issued Environmental Resource Permit (ERP)/ Surface Water (SW) and Works of the District (WOD) permits by basin¹ in the Northern Everglades Watersheds.

| Basin | Total Acres with ERP/SW Permits | Percent of Total Acres | Total Acres with WOD Permits | Percent of Total Acres |
|--|---------------------------------|------------------------|------------------------------|------------------------|
| Lake Okeechobee Watershed | | | | |
| Upper Kissimmee | 317,638 | 31% | 0 | 0 |
| Lower Kissimmee | 191,383 | 45% | 138,380 | 32% |
| Taylor Creek/Nubbin Slough (TCNS) S-133 | 10,373 | 40% | 17,198 | 67% |
| TCNS S-135 | 9,925 | 56% | 2,966 | 17% |
| TCNS S-154 | 11,467 | 36% | 25,314 | 80% |
| TCNS S154C | 0 | 0% | 2,080 | 97% |
| TCNS S-191 | 27,107 | 23% | 104,705 | 88% |
| Lake Istokpoga | 36,877 | 9% | 6,859 | 2% |
| Indian Prairie | 187,398 | 68% | 179,268 | 65% |
| Fisheating Creek | 101,655 | 34% | 244,587 | 82% |
| Nicodemus Slough | 16,838 | 87% | 17,866 | 92% |
| West Lake Okeechobee (WLO) S-4/Industrial Canal ² | 12,199 | 29% | 42,143 | 100% |
| WLO East Caloosahatchee ² | 110,324 | 54% | 32,961 | 16% |
| East Lake Okeechobee (ELO) C-44 ² | 88,934 | 67% | 500 | 0% |
| ELO L-8 | 84,660 | 79% | 4,566 | 4% |
| South Lake Okeechobee ³ | 241,838 | 75% | 310,839 | 97% |
| Total | 1,448,616 | 42% | 1,130,231 | 33% |
| Caloosahatchee Watershed | | | | |
| S-4 ² | 12,199 | 29% | 42,143 | 100% |
| East Caloosahatchee ² | 110,324 | 54% | 32,962 | 16% |
| West Caloosahatchee | 202,098 | 58% | 56,453 | 16% |
| Tidal Caloosahatchee | 123,642 | 47% | 0 | 0 |
| Coastal Caloosahatchee | 26,603 | 12% | 0 | 0 |
| Total | 474,866 | 44% | 131,558 | 12% |
| St. Lucie Watershed | | | | |
| C-23 | 69,985 | 63% | 12,783 | 12% |
| C-24 | 66,942 | 80% | 1,206 | 1% |
| C-25 and C-25 East | 77,313 | 78% | 2,673 | 3% |
| North Fork | 98,804 | 75% | 0 | 0% |
| Basins 4, 5 and 6 | 6,877 | 43% | 0 | 0% |
| South Fork | 31,676 | 65% | 0 | 0% |
| North Mid-estuary | 2,309 | 55% | 0 | 0% |
| South Mid-estuary | 968 | 47% | 0 | 0% |
| South Coastal | 5,012 | 63% | 0 | 0% |
| C-44 ² | 88,935 | 67% | 500 | 0% |
| Total | 448,821 | 70% | 17,163 | 3% |
| Grand Total⁴ | 2,160,845 | 45% | 1,203,346 | 25% |

¹ Overlapping ERP/SW records are not duplicated and Florida Department of Environmental Protection (FDEP) issued permits are not included. Overlap may exist between ERP/SW and WOD permits. The ERP/SW permit geographic information system data sets are known to have missing applications between 1984 and 1994. The compilation of these missing applications is expected to be complete in WY2015. Until such time acreage calculations may vary from year to year as data gaps are filled. 1 acre = 0.4047 hectares.

² Basins that are located in overlapping watersheds are presented in each watershed.

³ Includes both 40E-61 and 40E-63 permits.

⁴ Overlapping areas are counted once.

FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES BEST MANAGEMENT PRACTICE PROGRAMS

Agricultural BMP Rules and Manuals

FDACS' Office of Agricultural Water Policy works with agricultural producers to develop, adopt, and implement BMPs specific to various agricultural commodities. Pursuant to the NEEPP, where the FDACS has adopted agricultural nonpoint source BMPs or interim measures by rule, the owner or operator of an agricultural nonpoint source addressed by such rule shall either implement interim measures or BMPs, or demonstrate compliance with the District's WOD program under Chapter 40E-61, F.A.C., by conducting monitoring prescribed by the FDEP or the District.

These requirements are incorporated under FDACS' Chapter 5M-3, F.A.C. and Chapter 5M-12, F.A.C. for BMP implementation and conservation plan development, respectively. All FDACS-adopted BMP programs require agricultural producers who participate in the program to implement nutrient management, as well as other applicable BMPs. Chapter 5M-3, F.A.C., also addresses the land application of animal wastes within the Northern Everglades, provides criteria for submittal of a Notice of Intent to implement FDACS BMPs and contains record keeping requirements.

To date, the FDACS has adopted BMP manuals for most agricultural commodities as listed in **Table 4-9**. Most recently, the FDACS adopted a statewide citrus manual, Chapter 5M-16, F.A.C., Water Quality/Quantity Best Management Practices for Florida Citrus, requiring all producers enrolled in the original Ridge Citrus program re-enroll within 24 months of the rule adoption date of January 9, 2013. The equine BMP manual, Chapter 5M-14, F.A.C., was adopted effective March 15, 2012. Currently, the FDACS is revising manuals for container nurseries and vegetable and agronomic crops to incorporate BMPs for in ground nurseries and sugar cane and caladiums, respectively.

Table 4-9. Florida Department of Agricultural and Consumer Services (FDACS) BMP rule implementation. [Note: F.A.C. – Florida Administrative Code.]

| FDACS Adopted BMP Category | Rule Chapter F.A.C. | Associated BMP Manual | Implementation Timeframes ¹ | Reference |
|--|---------------------|-----------------------|--|-----------|
| Northern Everglades BMPs | 5M-3 | | | |
| Florida Container Nurseries | 5M-6 | Yes | According to timeframe identified in NOI – as soon as practicable for nutrient management | 5M-6.004 |
| Florida Vegetable & Agronomic Crops | 5M-8 | Yes | According to the timeframe identified in NOI – as soon as practicable for nutrient management | 5M-8.004 |
| Florida Sod | 5M-9 | Yes | As soon as practicable after NOI submittal for nutrient management. Within first year after NOI submittal for all other BMPs | 5M-9.003 |
| Florida Cow/Calf Operations | 5M-11 | Yes | 18 months after NOI submittal | 5M-11.004 |
| Conservation Plans for Specified Agricultural Operations | 5M-12 | | As soon as practicable within one year after NOI submittal for non-structural and nutrient management. Within two years after NOI submittal for all other BMPs | 5M-12.004 |
| Florida Specialty Fruit and Nut Crops | 5M-13 | Yes | 18 months after NOI submittal | 5M-13.004 |
| Florida Equine Operations | 5M-14 | Yes | 18 months after NOI submittal | 5M-14.004 |
| Florida Citrus | 5M-16 | Yes | 18 months after NOI submittal | 5M-16.003 |

¹ Some exceptions, as specified in the manuals.

Agricultural BMP Enrollment

A breakdown of the acres enrolled in FDACS BMP programs in the Northern Everglades is provided in **Table 4-10** and maps are provided in Appendix 4-1.

Table 4-10. Acres and estimated percentage of agricultural land enrolled in BMP programs by sub-watershed in the Northern Everglades Watersheds.

| Basin | Agricultural Acres ¹ | Total Acres Enrolled in FDACS BMP Program ² | Percent Notice of Intent Enrollment |
|--|---------------------------------|--|-------------------------------------|
| Lake Okeechobee Watershed | | | |
| Upper Kissimmee | 316,637 | 102,788 | 32% |
| Lower Kissimmee | 317,587 | 264,341 | 83% |
| Taylor Creek/Nubbin Slough (TCNS) S-133 | 14,896 | 10,548 | 71% |
| TCNS S-135 | 14,021 | 5,341 | 38% |
| TCNS S-154 | 27,427 | 23,981 | 87% |
| TCNS S-154C | 2,100 | 2,075 | 99% |
| TCNS S-191 | 106,722 | 97,028 | 91% |
| Lake Istokpoga | 193,093 | 142,405 | 74% |
| Indian Prairie | 254,317 | 191,366 | 75% |
| Fisheating Creek | 261,649 | 225,770 | 86% |
| Nicodemus Slough | 18,424 | 17,910 | 97% |
| West Lake Okeechobee (WLO) S-4/Industrial Canal ³ | 34,649 | 27,359 | 79% |
| WLO East Caloosahatchee ³ | 177,081 | 145,244 | 82% |
| East Lake Okeechobee (ELO) C-44 ³ | 92,088 | 32,927 | 36% |
| ELO L-8 | 15,175 | 8,677 | 57% |
| South Lake Okeechobee | 304,088 | 297,273 | 98% |
| Total | 2,149,954 | 1,595,033 | 74% |
| Caloosahatchee Watershed | | | |
| S-4 ³ | 34,649 | 27,359 | 79% |
| East Caloosahatchee ³ | 177,081 | 145,244 | 82% |
| West Caloosahatchee | 246,608 | 154,721 | 63% |
| Tidal Caloosahatchee | 82,158 | 64,855 | 79% |
| Coastal Caloosahatchee | 9,781 | 1,129 | 12% |
| Total | 550,278 | 393,308 | 71% |
| St. Lucie Watershed | | | |
| C-23 | 94,875 | 56,365 | 59% |
| C-24 | 68,419 | 41,257 | 60% |
| C-25 and C-25 East | 88,484 | 60,757 | 69% |
| North Fork | 37,736 | 12,798 | 34% |
| Basins 4, 5 and 6 | 2,648 | 87 | 3% |
| South Fork | 17,703 | 266 | 2% |
| North Mid-estuary | 0 | 0 | 0% |
| South Mid-estuary | 0 | 0 | 0% |
| South Coastal | 29 | 0 | 0% |
| C-44 ³ | 92,088 | 32,927 | 36% |
| Total | 401,981 | 204,457 | 51% |
| Grand Total⁴ | 2,798,395 | 1,987,268 | 71% |

¹ Agricultural acreages include Land Use Codes 2000-3210, 3300, and 4400-4430 and natural areas that are within Notice of Intent (NOI) enrollment boundaries. Land use codes 2240 (Abandoned Groves), 3100 (Herbaceous Dry Prairie), 3200 (Upland Shrub and Brush land) and 3210 (Palmetto Prairies) are excluded where not covered by an NOI. Lake Istokpoga and Lower Kissimmee acreage includes Avon Park Air Force Range (code 1730) lands covered by NOI. Acreages calculated by SFWMD. 1 acre = 0.4047 hectares

² NOI enrollment acreage data provided by FDACS based upon the June 2013 enrollment database.

³ Basins that are located in overlapping watersheds are presented in each watershed.

⁴ Overlapping areas are counted once.

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